The Chemical Age

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A Powerfully Organised Industry

THE summer has seen events such as the influx of chemical industrialists that occupied our attention in June and July—surely the most welcome of imports!—that cause us to pause to ask how we stand amid the chemical industries of the world. The events of 1914-1918 showed that the potential power of a nation does not depend only on its armed forces, its ships and its guns; it depends equally on the possession of industrial plants able to supply those armies with the mechanised implements with which to carry on their work and with the many chemicals without which guns cannot be fired, mechanised troops cannot move, and armies cannot be maintained in health in the field. It is not, however, necessary to entertain thoughts of attack and defence to realise the value of a prosperous chemical industry to the industrial life of any nation. It is probable that never before were chemical substances used in such quantities nor in such immense variety, and unquestionably the power to produce at home a high proportion of these substances must be an important asset on the national balance sheet.

A strong national chemical industry depends upon many things. It depends in the first place upon the possession of raw materials. As a country we are not rich in a varied assortment of these necessities, but at least we have supplies of coal, of lime-stone and of salt, together with iron ore, lead and some other metals. Gasworks extract from their coal perhaps one-third of our needs of sulphur, and it only requires the most moderate of tariffs for it to become profitable for this quantity to be doubled by extracting sulphur from coke-oven gas. From the coal we can produce the greater part of the intermediates required for dyes and other organic chemicals, as well as unlimited and cheap supplies of the greatest of all raw materials of the chemical industry—power.

Given the raw materials, the next necessity is capital, a need which involves the possession of the capital and the courage and vision on the part of the capitalist to use it. Capital is a timid bird that is apt to take wing upon the smallest provocation and that will not settle unless a little corn is spread to give promise of food. The Government spread the corn in the form of tariffs that gave home industry a real chance of reorganising itself; industry spread more corn in the shape of research that promised new industries and new opportunities for successful industrial enterprise. The joint effects upon the older established industries were such as to encourage both investment and the development of new processes and improved plant. The old industries were modernised and new ones established.

A third need is the possession of a strong chemical plant manufacturing industry, and that also is now ours. It is doubtful whether the war was substantially responsible in bringing this industry into being on its present scale, but unquestionably it turned the thoughts of engineering works in that direction. The slump of 1929 and following years caused many engineering concerns to cast about for new lines of business and undoubtedly assisted in the stabilisation of chemical plant manufacture. The equipment industries in general are certainly in a flourishing state and are said to have on hand more orders than ever before.

More steel is being made than in 1913, a boom year, and the engineering works are finding difficulties in getting supplies. Finally, no chemical industry could have been successfully established without the availability of the necessary personnel. There must be men fitted to direct the industry from the board room. There must be the staff from the manager to the foreman and comprising between all those chemists, chemical engineers, research chemists, *et hoc genus omne*, that go to make up the brains of a chemical undertaking; and there must be an efficient and contented body of workmen able to operate the plant.

As the result of this concentrated effort we have been able to show our foreign visitors a British chemical industry that is powerfully organised to fulfill its functions. The synthetic production of fuel oil is a great recent triumph; all those products that we formerly produced from wood distillation are now made synthetically; we make over 4,000 fine chemicals for medicinal, photographic, cosmetic, and many other purposes; we now make over 90 per cent. by weight of our requirements of dyes, although in 1913 we made but 20 per cent.; we discover new dyes and yearly increase our range of colours; in the field of coal carbonisation we are in some respects the equals and in others the superiors of any other nation; our chemical industry, and the heavy chemical industry in particular, has been reorganised so that its efficiency has been improved by the concentration and modernisation of plant, a development for which the genius of the late Lord Melchett was responsible; we now make synthetic hydrochloric acid from the by-products of the alkali industry; we oxidise ammonia to nitric acid; many new processes of water sterilisation have been introduced and vast progress has been made in the purification, and even utilisation, of industrial effluents; the refining and desulphurising of metals by sodium carbonate and the molten cyanide method for case hardening steel are all among the recent developments. A whole article could be written on fertilisers and on the agricultural research work that is being undertaken.

Notes and Comments

The Voice of the Provinces

THE report of the annual conference of hon. secretaries of local sections of the Institute of Chemistry which we summarised last week throws valuable light on the problems which the provincial sections of all the chemical organisations in this country have to encounter. Despite the numerical superiority of the London sections, it is to the provinces that the societies have to look for their real strength, and anything that can be done to sustain and increase the active interest of the members far removed from headquarters is to be encouraged. Almost all the subjects that came under review at the conference are more or less common to the local sections of all the other bodies, and it would be well if they followed the example of the Institute and gave their local officials an annual opportunity of exchanging views and experiences. It may be argued that the interests of the provinces are already served by district members of the various councils, but a perusal of the report of the meeting of local Institute secretaries shows that there is a good deal of ground not covered in any other way. Moreover, the deliberations of councils are seldom, if ever, reported at length, and if they are, they are usually concerned with national rather than local topics, whereas the local secretaries' conference provides a suitable opportunity for a full record of sectional activities.

Hull as a Chemical Centre

ANXIOUS to encourage the establishment of industries for which it can be proved that suitable opportunities exist in the area, the Hull Corporation has issued an unusually informative survey which clearly establishes the city's claim to be the centre of tremendous chemical activity. The city, with its immediate neighbourhood, is advantageously placed in several respects for the manufacture of many articles, the production of which requires the use of large quantities of alcohol, acetone, acetic acid and butyl alcohol, and many other solvents and related chemical compounds. All these compounds are made in the area. Amongst the manufactured products requiring the specified chemicals for their production are the synthetic fibres; plastics based on cellulose compounds (from wood or cotton) for lacquer and varnish making; paints and enamels; photographic and other films; perfumery; synthetic resins; artificial leather; polishes; and pharmaceutical and medicinal preparations. For all these industries the Hull Distillery Co., Ltd., at Saltend, makes alcohol; this alcohol is largely used by the adjoining Saltend Company (British Industrial Solvents, Ltd.) for the manufacture of the various solvents and derivatives. Acetylene in the form of dissolved acetylene (in acetone, prepared at Saltend) is available here, being produced by the British Oxygen Co., Ltd. Many fractions obtained by the distillation of petroleum and coal-tar are made by Major and Co., Ltd., and E. Hardman, Son and Co., Ltd.; and the British Gas Light Co., Ltd., obtains certain by-products in the production of coal-gas, such, for example, as ammonia, which is usually converted into the sulphate, nitrate or other salt. As regards the paint industry, already established in the district, many of these newer products are now used in combination with linseed and other oils for the manufacture of quick-drying varnishes, etc., and Hull is eminently suitable as the place for the economical expansion of this industry.

The Industrial Survey

STATISTICS published in the Board of Trade survey of industrial development in 1935, indicate a general advance in industrial activity in Great Britain, but they fail to provide a basis for any precise conclusions either as to the geographical movement of a particular trade or the value or volume of the products manufactured. The opening of 510 factories and the closing of 486 implies an increase of only 24, but even this simple calculation is misleading in that in many instances the closure of a factory was the final stage of a long process of slow decline. The survey discloses that thirteen new chemical factories were opened during the year, seven were extended and seven were closed, but it must be borne in mind that at least three were closed owing to transfer on re-organisation and two had only been opened in the previous year. New chemical works mentioned in the survey include a new branch synthetic fertiliser factory at Billingham employing over 2,000 persons, industrial alcohol and solvents at Bromborough (over 200), manufacturing chemists at Shoreditch, transferred from Hornchurch (over 100) and chemicals at Trafford Park (over 100). Extensions to chemical works were mainly of a minor character, none of them involving an increase of as many as 100 employees. The seven closures during the year included two gunpowder works in North-East England (transferred to Ardeer on re-organisation) and one washing powder works in the Midlands (transferred to Warrington on re-organisation).

Automobile Research

THE research programme at the new laboratories of the Institution of Automobile Engineers, which Lord Rutherford opened at the Great West Road, Brentford, six months ago, is being actively pursued, and the facilities and equipment installed are affording opportunities for considerable extension of the work of the research and standardisation committee which has just issued its fifth annual report. Chemical and metallurgical problems enter so largely into the automobile industry that there would appear to be no limit to the amount of research work that can usefully be undertaken on a co-operative basis, and the new premises and increased staff undoubtedly provide the "ways" if the "means" are available. In this connection a determined effort is being made to effect an all-round increase in the subscriptions so as to qualify for an additional Government grant of £2,500. The total amount subscribed by the industry in 1935 was approximately £7,500, of which £2,500 came from the Society of Motor Manufacturers and Traders, and the additional Government grant will be obtained provided £10,000 can be collected from the industry. Estimates of grant-earning income for the current year on the basis of increased membership and the voluntary augmentation of individual subscriptions indicate that the desired goal of £10,000 is well within reach.

The British Association at Blackpool

Sir Josiah Stamp on the Impact of Science on Society

SIR JOSIAH STAMP on Wednesday evening delivered his presidential address to the British Association, which is holding its annual meetings at Blackpool for the first time in its history. The subject of his address was "The Impact of Science on Society."

The impact of science upon society, he said, was in general exerted indirectly, by the effects of its applications upon people's habits, numbers, and location. The impact could be made more difficult by the rigity and repugnance to change of the social institutions affected. A striking example of this was being witnessed in the United States, where an eighteenth century constitution was proving not a shock absorber but a shock producer for the process of change. Indeed, institutional resistance might in certain cases actually discourage advance in pure as well as applied science.

The Position of the Laboratory Scientist

In regard to the genesis of scientific impact upon society what was the position of the inventor or laboratory scientist? Up till a century ago, after making his invention or discovery, the inventor had to wait upon the whims of a rich or influential patron. To-day, business and Government were increasingly prone to encourage continuous research on a large scale. As a result the length of "industrial gestation"—*i.e.*, the period between the time when a new scientific discovery or idea arrived at the stage when it was capable of application, and that at which it was actually applied on an industrial scale—had of recent years been materially shortened (though this shortening had probably increased the "social cost" of the change).

Whereas the scientist produced social changes, he rarely troubled his head about these inevitable results of his work. If he did so, he thought in terms of benefits conferred, not of the friction, waste, and social shocks engendered. In general, the process of impact and shock absorption was a no-man's land. The scientist usually regarded it as altogether outside his purview; the economist, perhaps more surprisingly, rarely acknowledged any duty to study this phase of his subject; and Government hardly ever intervened until the change had generated a vested interest.

Science and the Power to Think

"I have long watched the processes by which the scientific specialist 'makes up his mind' in fields of inquiry outside his own. It seems still a matter for investigation whether the development of a specialist's thinking on balance impairs or improves the powers of general thinking compared with what they might otherwise have been. We do not know the kind or degree of truth that may rest in Anatole France's aphorism: 'The worst of science is, it stops you thinking.' Perhaps this was more subtly expressed in the simpler words of the darkie mother: 'If you haven't an education, you've jest *got* to use yoh brains.' My own experience is that when the attempt to deal with social consequences is made, we quickly find ourselves either in the field of larger politics debating the merits of the three prevalent forms of State government, or else performing miracles with fancy currencies and their blue prints reminiscent of the chemical engineer." But whatever form of government or economic system was envisaged, there would remain certain essential features of the impact to study and to control.

They must try to minimise the waste of ability caused by the enforced unemployment of highly-trained labour. They must try to minimise the waste of savings, skill, and effort caused by the scrapping of machines and factories long before they had worn out naturally. And they must try to minimise the waste of all that made life worth living involved in the uprooting of labour from its ties of home and kindred and early associations. However, these three rightful "obstructions to change" were not rigid.

The share of scientific impact in causing unemployment was less than usually supposed. In any case there were two aspects of the question which had been insufficiently studied. The first he would refer to as the "balance of innovation." Some of the changes due to scientific advance were "work-savers," enabling existing commodities to be produced at lower cost, in money and in labour. But others were "work-creators," involving the creation of quite new objects of demand, which would be desired in addition to existing commodities. The released purchasing power and released (unemployed) labour resulting from "work-saving" advances could best be brought together again in relation to such new commodities.

Safety Valve of Population

The second aspect was the safety valve of population. A natural increase of population was the best shock-absorber that the community could possess, especially if accompanied by an extension of territory such as the United States enjoyed in the constant westward movement of the frontier in the nineteenth century, or Britain in the period of oversea emigration. The problem now before all Western industrial countries was the fact that their populations were shortly becoming stationary and then would begin to decline noticeably, and this safety valve of increase in population would no longer be available. The impact of science upon a stationary population was likely, *ceteris paribus*, to be much more severely felt than upon a growing population, because the changes of direction could not be absorbed by the newly directed workers.

"The necessity for a concentration upon new theoretical and analytical analysis, and upon realistic research, is very great. But so also is the need for widespread and popular teaching. For a single chemist or engineer may by his discovery affect the lives of millions who enter into it but do not understand it, whereas a conception in economic life, however brilliant, generally requires the conformity of the understanding and wills of a great number before it can be effective."

Ordered Knowledge Required

Ordered knowledge and principles were wanted at every point. The initial impact of new science was in the factory itself. The kind of remedy required here was covered by the work of the National Institute of Industrial Psychology, which invoked the aid of many branches of science. It was the very first point of impact. Yet its finance was left to personal advocacy and commanded not 10 per cent. of the expenditure on research in artificial silk, without which the world was reasonably happy for some centuries. Again, the scientific ancillaries of medicine had made immense strides. Clinical medicine as an art made tardy, unscientific, and halting use of them.

"My predecessors have spoken of the shortcomings of the active world—to me they are but the fallings short of science. Wherever we look we discover that if we are to avoid trouble we must take trouble—scientific trouble. The duality which puts science and man's other activity in contrasted categories with disharmony to be resolved, gaps to be bridged, is unreal. We are simply beholding ever-extending science too rough round the edges as it grows. What we have learnt concerning the proper impact of science upon society in the past century is trifling compared with what we have yet to discover and apply. We have spent much and long upon the science of matter, and the greater our success the greater must be our failure unless we turn also at long last to an equal advance in the science of man."

The Chemist in the Service of the Community

Professor J. C. Philip's Address to the Chemistry Section

FOR the promotion of natural knowledge and the increase of our understanding of the universe, the chemist has laboured with extraordinary success, both in his own fields and in those borderlands where chemistry marches with other sciences, said Professor J. C. Philip, D.Sc., F.R.S., in his presidential address on "Training the Chemist for the Service of the Community," to the Chemistry Section of the British Association at Blackpool.

While our knowledge of atomic structure is to be credited mainly to the work of physicists, the chemist's technique has revealed the molecular architecture of the most complex natural products, and on the basis of this knowledge the same materials can be synthesised in the laboratory. One has only to think of the sugars, the alkaloids, the anthocyanins, to realise the astounding results which have been achieved in this field of investigation, while such elusive substances as the vitamins and the sex hormones are rapidly yielding their secrets to the strategy of the organic chemist.

The World of Neglected Dimensions

Take again that region in the scale of size which lies between the molecule and the visible particle—the colloid region—the "world of neglected dimensions" as it was once described. In this region, as the physical chemist has shown, the relatively great extent of surface is marked by quite special behaviour, and the labile systems encountered exhibit peculiar characteristics—characteristics which are highly significant for the understanding of physico-chemical changes in the living organism. Our knowledge of this field of surface chemistry is still extending rapidly.

Once more, think of the tracking down of the factors which affect the rate of chemical change and the elucidation of the mechanism of their operation—a little moisture, a speck of dust, a trace of acid, a roughened surface, a ray of light, a rise of temperature, any of these may have a notable influence on the rate of a reaction. The physical chemist has been remarkably successful in unravelling the rôle of these various factors and interpreting their significance. It is in such a field as this—the field of kinetics and catalysis—that the progress of chemical science from the qualitative and descriptive way of treating phenomena to the rational and quantitative has been particularly marked.

These are only one or two of the directions in which the pioneering work of the chemist has opened the way to a fuller knowledge of nature, especially in the more delicate aspects of her balance and her transformations. In the pursuit of natural knowledge for its own sake, the chemist has indeed travelled far, and his exploration has yielded an abundant harvest of discovery. For the pioneer himself it is an adventure, and original research may provide thrilling experiences.

Practical Applications

Again and again in the history of the science observations and discoveries have been made, which at the time were of purely scientific interest but which later received important practical applications. The laboratory curiosities of a former generation, such as aluminium and tungsten, have become the industrial commonplaces of the present. The application of exact methods of measuring density revealed the presence of a new gas in the atmosphere—a discovery of purely scientific interest in the first place—which has led to a whole train of remarkable consequences, from a drastic revision of our ideas about the elements to the widespread development of illuminated signs. Just one hundred years ago, at the Bristol meeting of the Association in 1836, Edmund Davy announced the discovery of a "new gaseous bicarburet of hydrogen," now familiar as acetylene. Decades passed, however, before the novel gas acquired any practical significance, and indeed it was not until 1892, when a large-scale method for producing calcium carbide was discovered, that acetylene became of industrial importance. Since then its applications have gone ahead rapidly, and its uses in illuminaton, in welding, in metal-cutting, and in the sythetic production of organic chemicals are known to us all.

In view of these lessons from the history of chemical science one hesitates to apply the epithet "useless" to any specific observation or discovery, however "academic." Reflection indeed suggests that the really big changes in the material conditions of human life have generally had their origin in a search for knowledge on its own account.

A Great Reserve of Knowledge

There is, however, much more to be said on this matter of fundamental or academic research. A solution of the most practical of chemical problems on rational and scientific lines is possible only because of our accumulated knowledge of natural phenomena and natural laws. It is only against the background provided by the pure research of yesterday that the technical problems of to-day can be viewed in their proper setting and tackled with a reasonable prospect of success. Work in pure science, remote as it generally is from the practical issues of the moment, is building up a real reserve of knowledge and technique on which future generations of practical workers will be able to draw.

Apart from the chemists who are engaged, mostly in our universities and colleges, but to some extent also in the larger research institutes, in the general task of extending the boundaries of knowledge, there are many more who are carrying on what may be called "directed" research. Their work aims at the solution of some specific problem, concerned, it may be, with the improvement of an industrial process, the elimination of waste, the safeguarding of health, the utilisation of by-products, the synthesis of antidotes. More definitely, and by way of example, the object may be to discover a fast blue dye, to purify a water supply, to find a rustless steel, to produce petrol from coal, to isolate a vitamin, to make a non-inflammable film or a creaseless cotton fabric. The general public, however dubious about pure research, would probably admit that the satisfactory solution of any one of these problems would be of service to the community; but it must be emphasised once more that the chemist can do these things only by virtue of his inheritance of knowledge and technique.

Past Twenty Years' Progress

In the last twenty years the amount of directed chemical research in this country has increased enormously. Industries of the most varied description have begun to realise the potential value of the trained chemist in solving their special problems and putting their manufacturing process on a more rational basis. In this general movement the State, through the Department of Scientific and Industrial Research, has taken a prominent part by fostering research associations. The work of these organisations—such as those dealing with rubber; with paint, colour and varnish; with cotton or wool; with non-ferrous metals; with sugar confectionery—is in many cases largely chemical or physico-chemical in character.

Fuel and food are two notable cases in which State-aided investigation is being carried out, and problems connected on the one hand with pulverised and colloidal fuel or the low-temperature carbonisation of coal, and on the other with the storage of fruit or the preservation of fish and meat, are being intensively studied at appropriate centres. Reference might be made also to the work of the Building Research Station, where, amongst other matters, the factors determining the weathering qualities of stone are being studied. Other experts

than chemists are naturally concerned in the investigation of these problems, but the chemical and physico-chemical aspects are frequently the predominating ones.

The question of river purification also demands the collaboration of other scientists with the chemist, and indeed the attack on many such problems, especially those affecting the health of the community, is likely to be successful only by the co-operation of teams of scientific workers from different fields. Smoke and fog, which not only present the scientists with interesting phenomena but constitute also a social and industrial problem of vital importance, concern the physicist, the physical chemist, the analyst, the fuel engineer and the meteorologist, and it is only when the knowledge and experience of these workers are pooled that there is any hope of interpreting the phenomena and solving the problem.

The Function of the Chemist

Research, whether fundamental or directed, is by no means the only outlet for the chemist's knowledge and craftesmanship. The works control of chemical processes, the examination of factory products, the safeguarding of the purity of food, and the supervision of water supplies and sanitation, are examples of other activities of a more routine character in which large numbers of chemists are engaged. These are, so to speak, the general practitioners of the chemical profession, and their contribution to the smooth running of industry and to healthy living is far greater than most people suppose.

A just estimate of the chemist's function is almost impossible for those who associate him chiefly with explosives and poison gas and regard him as a particularly devilish kind of scientist. Such a picture is hopelessly out of relation with the facts. It is, of course, true that chemists have produced dangerous and poisonous substances, but most of these were discovered originally in the general quest for knowledge, and many have legitimate and valuable applications; their use for destructive purposes is a perversion. Phosgene, for example, one of the so-called poison gases, was discovered more than 100 years ago, and is an important material at the intermediate stage in the manufacture of certain dyestuffs. Nitrates, which are the basis for the manufacture of most explosives, play a prominent rôle as fertilisers in agriculture, and explosives themselves are indispensable in mining operations.

Like other scientists, the chemist normally has a constructive point of view, and he cannot but deplore the fact that, as Sir Alfred Ewing said in his presidential address: "The command of nature has been put into man's hands before he knows how to command himself." Speaking for the vast majority of fellow chemists, we dislike intensely the present world-wide prostitution of knowledge and skill to destructive ends. The sooner this is eliminated, and the less call there is for lethal and devastating materials, the greater will be our satisfaction.

The Need for Chemical Direction

Inadequate realisation of what the chemist even now means for the community and failure to grasp his potentiality for development and progress may have unfortunate consequences in the commercial world. How often is it the case, although there are notable exceptions, that an industrial concern depending essentially on the successful operation of chemical or physico-chemical processes is controlled by a board of directors elected solely by virtue of their financial qualifications.

Such men, as a rule, are without real appreciation of scientific method and scientific research, and, in the absence of a technical member who can speak with authority on these matters—a technical employee obviously cannot carry the same weight—such a board may make serious mistakes of omission or commission. No amount of financial manipulation, however skilful, can make up for the lack of enlightened scientific control.

If chemists feel that the fundamental and widespread part which their science now plays in the community is not sufficiently realised, and if they consider that their profession should have greater influence in commercial, industrial, and national affairs, the remedy lies to some extent with themselves, both individually and collectively.

The Hydrogenation of Coal

American Chemical Society's Symposium

A SYMPOSIUM on "The Hydrogenation of Coal" was held jointly by the Division of Industrial and Engineering Chemistry and the Division of Gas and Fuel Chemistry at a meeting of the American Chemical Society at Pittsburgh, which opened on Monday.

Discussing the chemical constitution of a bituminous coal as revealed by its hydrogenation process, BURNARD S. BIGGS and J. F. WEILER said that by catalytic hydrogenation, first over Adkins catalyst at 350°, and then over Haney nickel catalyst at 220°, approximately 80 per cent. of the carbon of the extract and of the residue from the benzene extraction of a Pittsburgh seam coal at 260° has been converted to hydroaromatic oils which can be regarded as the hydrocarbon skeletons of the building units in the respective materials. Fractionation of these oils followed by characterisation of the fractions through their molecular weights, boiling points, refractive indices, and hydrogen-carbon ratios has given an approximate distribution of the various sized units in the extract and in the residue.

The action of aqueous alkali on a bituminous coal was referred to in a paper by LEO KASEHAGEN, who had carried out investigations at temperatures from 250° to 400° and at sodium hydroxide concentrations from 1 N to 100 per cent. The major products were coke-like residues which could be produced at temperatures as low as 275°, although the temperature of initial plasticity of Edenborn coal is 393°. Using 5 N sodium hydroxide, the oxygen and hydrogen contents of the residues became progressively lower as the temperatures of the treatments were increased, but when alkali concentrations of 60-80 per cent. were used, the lowering of the oxygen content occurred with very little lowering of the hydrogen content, so that from the standpoint of hydrogen economy residues so produced are more suitable for hydrogenation than the coal itself.

Hydrogenation of these residues yielded a product which was more hydrocarbon-like in composition than the product from a similar hydrogenation of the coal, and which showed some of the characteristics of a lubricating oil. Other products consisted of a solid phenolic material of high molecular weight, a viscous liquid of neutral nature, carbon dioxide, free hydrogen and gaseous hydrocarbons. The oxyyen in the carbon dioxide, and the free hydrogen, came partly from the coal and partly from the decomposition of water. The nature of the products supports the theory that the coal substance is made up of complex condensed ring systems, with oxygen present in the form of ether or heterocyclic linkages. Similar results on alkali treatment of the coal and the amorphous portion of the benzene extract indicate the natures of the two materials to be the same.

Giving a comparison of some of the hydrogenation products of coal and oil, M. PIER pointed out that by destructive catalytic hydrogenation, fuels like coal, tar, petroleum and

shale oil give high yields of products usually obtained from mineral oils. Practically the only by-product is a certain amount of gaseous hydrocarbons which, however, may be utilised in the process by conversion to hydrogen. Catalytic hydrogenation makes possible the production from the same raw materials of different final products such as fuel oil, lubricating oil, diesel oil, illuminating oil, or gasoline, according to the market demand.

In the sump phase hydrogenation which was described, heavy raw materials are treated in the liquid state. Such materials as asphaltic petroleum or cracking residues, tars, and coals (the latter finely ground and pasted with oil) are mixed with a finely divided catalyst and subjected to hydrogenation at elevated pressure and at temperatures of about 400 to 500° C. In this manner, heavy oil, middle oil and some gasoline are produced. The middle oil can be further split in the gas phase to gasoline over lump shaped catalyst, rigidly arranged in the reaction vessel. The same catalyst arrangement may also be used just as well for the improvement of lubricating oils and illuminating oils, for the refining of gasoline, benzol, etc., and for the production of anti-knock gasoline. The life of rigidly arranged catalyst is much longer than one year.

Valuable Properties Retained

It is characteristic of catalytic destructive distillation that the conversion of the raw materials can be carried out so mildly that their valuable properties are retained in their hydrogenation products. In this case, the composition of the raw material reappears in the ultimate analysis of the hydrogenation products of the sump phase, *i.e.*, asphalts, heavy oils, middle oils, sump phase gasolines. The analytical figures become increasingly similar as the boiling point of the products compared decreases, but even with the gases differences are still noticeable. There is a marked similarity of sump phase products from oil residues and straight run products from the same crude oils. Products of the sump phase hydrogenation, when using but small amounts of finely distributed catalyst, still contain some part of the oxygen, nitrogen, and sulphur compounds present in the raw material. The products treated over rigidly arranged catalyst, however, are usually completely refined.

The equipment used for the hydrogenation is in all cases practically the same. A plant which has been used for oil can be converted easily for tar or coal. However, in the latter case, additional equipment has to be provided. Also with the same equipment a great variety of final products may be obtained.

Fuel Research in Canada

T. E. Narren and R. E. Gilmore described in detail an apparatus and method for continuous hydrogenation tests on coal and other materials, as developed at the Fuel Research laboratories of the Canadian Department of Mines. The hydrogen is continuously analysed, compressed and passed to the bottom of the reaction chamber. This is an electrically heated vertical tube 10 ft. in length with an internal diameter of 2.74 in. A suspension of powdered coal in oil, produced in a previous cycle, together with stannous oxide as the catalyst is charged also to the bottom of the reaction chamber. The product is withdrawn from the top of the chamber cooled to room temperature, and collected in a receiver where it separates into liquid and gaseous fractions. The gaseous fraction, which is largely hydrogen, is measured and recirculated through the reaction chamber without reducing the pressure. The liquid product is withdrawn at regular intervals from the receiver.

This apparatus and procedure were used in experiments on a typical high volatile bituminous coal for the purpose of determining the effects of changes in three operating variables, *viz.*, pressure, rate of charging and temperature. The best yields as per cent. of the charge of ash-and-moisture-free coal were as follows: Hydrogen used, 8.0; net oil produced, 77.6; solid residue, 6.3; water, 7.7; gas and loss, 15.7. These yields were obtained with a temperature of 829° F., a pressure of 2,940 lb. per sq. in., and a charging rate of 8.83 lb. of paste per hour. At a pressure of 2,430 lb. per sq. in., with other conditions as previously stated, the yield of oil was 72.5 per cent. At a rate of charging of 6.04 lb. per hour the yield of oil was 53.7 per cent., and at a temperature of 657° F. the yield of oil was 54.9 per cent.

In 1923 experimental work on hydrogenation was started at the Fuel Research Station, Great Britain, to ascertain whether British bituminous coals could be readily converted to motor spirit, said F. S. Sinnatt, J. G. King and Angus Macfarlane, in a general paper on the subject of hydrogenation. After a study of catalysts, an experimental plant of one ton per day capacity was constructed. The mechanism of coal hydrogenation has been studied especially for the light it sheds on coal constitution. Special attention has been given to the hydrogenation and treatment of low temperature tars, the properties of which are described. The influences of pressure and temperature upon the hydrogenation and cracking of the aromatic constituents of low temperature tars are reviewed, especially with reference to naphthalene.

The influence of temperatures from 300° to 500° C. and of pressure at 200 and 400 atmospheres on the hydrogenation of tar in a continuous plant were studied. After hydrogenation above 370° C. the tar loses its black colour but remains opaque; at 450° C. the product is transparent and pale yellow in colour. Deterioration of catalyst increases with increasing temperature of operation.

An experimental procedure for the complete conversion into liquid or soluble products of all the banded constituents of bituminous coal other than fusain was outlined by C. C. Wright, N. M. Baldwin, C. C. Haiao and A. W. Sauger. Experimental data were presented to show that the degree of conversion obtainable by hydrogenation of organic material in bituminous coal is limited only by the percentage of fusain present in the coal treated and by the conditions of the hydrogenation. The petrographic characteristics of the fusain residues and of the residues in which incomplete conversion has been obtained were discussed.

Sir John Cass Technical Institute

Arrangements for 1936-1937 Session

The new session of the Sir John Cass Technical Institute, Jewry Street, London, which extends over about 36 weeks, will begin on September 21, and students will be enrolled next week. The Institute provides instruction in pure and applied mathematics, physics, chemistry, biology, botany, zoology, bacteriology, malting and brewing, petroleum technology, fuel technology (including coal carbonisation and gas engineering), chemical engineering, metallurgy, assaying, geology, modern languages, arts and crafts and tailoring. The science courses are arranged to meet the requirements of those engaged in the chemical, metallurgical, electrical, petroleum and fermentation industries, and are held from 6 to 10 p.m.

The syllabus includes a post graduate course in the design, construction and operation of chemical plant suited to the requirements of those desiring to prepare for the examinations of the Institution of Chemical Engineers, commencing on October 12, a course of lectures by Mr. W. A. Wood on applications of X-ray analysis to chemical problems, a course by Dr. T. G. Pearson on micro-chemical analysis, a course by Dr. G. W. Scott Blair on colloids, and a series of evening courses on fuel technology.

Full facilities are provided in well-equipped laboratories for special investigations and research. The instruction in experimental science also provides systematic courses for the examinations of the University of London, the Institute of Physics, the Institute of Chemistry, the Institute of Brewing and the Institution of Gas Engineers. The principal and heads of departments will be pleased to advise intending students at the commencement of the session on the course they should undertake.

The Chemistry of Rubber Synthesis

A General Review

THE " Technische Blätter " (No. 20, 1936, page 322) gives a review of the chemistry of synthetic rubber production, stating that it was in 1909 that the German chemists, F. Hofmann and O. Harries, established the fact that the large molecule of natural rubber is a polymerisation of a number of smaller molecules.

As generally known, polymerisation is the combining of a number of similar small molecules to form a large molecule; there is no chemical change in the ordinary sense, but the molecules which polymerise have still some unused combining power which is utilised to form the new product which has the same elementary percentage analysis as the smaller molecules from which it is built up. Polymerisation takes place between unsaturated molecules, and synthetic rubber is formed from the polymerisation of molecules of this type. The unsaturated bodies in question belong to the di-olefines with two double compounds in the molecule of the type $C_3=C.C=C$. To this group belong dimethylbutadiene and methylbutadiene which, under the name of " Isoprene," was the raw material for the synthetic rubber produced in Germany during the war. This, and butadiene itself, is the raw material of the present German synthetic rubber production. Butadiene is distinguished from isoprene merely through possessing one less CH_3 group, and is of greater interest than isoprene for the rubber synthesis because it is easier to produce, and its polymerised product in the vulcanised condition is superior to the corresponding product from isoprene.

Production of Butadiene and Chloroprene

The most important process for producing butadiene is the conversion of acetylene into butyleneglycol and splitting off water from this. Acetylene is first converted to acetaldehyde by the action of sulphuric acid in the presence of a mercury salt, a process which is similar to the first stage of producing alcohol from acetylene. The acetaldehyde, by the action of a dilute alkali solution, is then subjected to the so-called aldol condensation by which two molecules of the aldehyde unite to form aldol ($CH_3.CH(OH).CH_2.COH$) and by removing two molecules of water from aldol butadiene ($CH_2=CH.CH=CH_2$) is obtained.

In recent times a number of other methods have been developed in which the raw material are gases formed in petroleum cracking, or in the pressure hydrogenation of petroleum, coal, etc. One possibility is to pass these gases through an electric arc to produce acetylene, and then to proceed as already described. This method has the advantage of producing acetylene free from catalyst poisons. Also vinylacetylene ($CH_2=CH.C=CH$) formed by treating acetylene with cuprous chloride can be converted into butadiene by a catalytic partial hydrogenation. Vinylacetylene is also the raw material for producting a chloroprene ($CH_2=CH.CCl=CH_2$) from which duprene is polymerised. It is also possible to decompose alcohols into olefines and to hydrogenate this to butadiene. This is a method, used in Russia where ethyl alcohol at slightly under-pressure is conducted over a mixed de-watering and de-hydrogenating catalyst by which butadiene is produced with a yield of about 34 per cent of the theoretical.

Polymerisation with Alkali Metal

For the polymerisation of butadiene and other raw materials for the rubber synthesis, there are two principal methods: polymerisation in the mass, and polymerisation in the emulsified condition. The first method is the older and less perfect; it has been much improved in recent times, and is practically employed in Russia. As catalyst, metallic sodium in the form of wire or small balls is used. This method was also used in Germany before and during the war, and gave products of low plasticity, elasticity, and strength, difficult to vulcanise, and particularly requiring a long time in production. By the employment of regulators and means of diluting, the process is now much more satisfactory. The diluents are ethers, esters, acetal, hydro-aromatic or aliphatic ketones. In Russia, butadiene in 70 per cent. concentration is polymerised with sodium, yielding an end product with a greater elasticity range than natural rubber, not becoming hard at low temperatures, nor softening at temperatures of 80—100° C., but tending rather to become harder; like natural rubber, it can be regenerated.

Improved Methods

As regulators, many substances have been proposed, most of which greatly accelerate polymerisation so that a period of a few days only is required compared with one of several months during the war. By the improved method, butadiene with 0.4 per cent. sodium and 5 per cent. dioxane can be polymerised in a rotating autoclave in 1½ days to yield a good product which can be readily vulcanised. Small quantities of saturated and unsaturated organic halogen derivatives yield similar results. For example, butadiene with 0.4 per cent. sodium in the presence of 0.01 per cent. vinylchloride at 60°, is polymerised in 1½ days. Also, small additions of ammonia and amines as regulator have been found effective. Butadiene with 0.5 per cent. sodium and 0.5 to 1 per cent. aniline is polymerised to the full extent in 30—40 hours at a temperature of 80—85°, yielding a product which is workable and especially amenable to filling.

Stable hydrocarbons of low boiling point are useful additions in quantities of 10 to 20 per cent. These function to promote swelling of the rubber product, and also as diluents, thereby increasing plasticity and diminishing the viscosity. When impure raw materials are employed, such as result from the thermal decomposition of gases, etc., these hydrocarbon additions are valuable. For example, 100 parts of butadiene with 0.5 per cent sodium, to which is added 10 parts of cyclohexane, heated at 25° C. for 3 days, yields a highly plastic rubber product.

Polymerisation of Emulsions

The fact that natural rubber is obtained as latex, which is an emulsion, has suggested the polymerisation of diene in the emulsified condition. One advantage obtained is the short time required for the polymerisation, and another is the lower temperature necessary which tends to reduce the oily by-products. The polymerised product is also more easily worked than the product obtained otherwise. The emulsions can be concentrated to a paste which, after long storage, returns to the original liquid condition and, like the natural rubber latex, can be coagulated. Diene is emulsified in an aqueous solution in which soaps or similar acting substances, such as oleates, stearates, sulphite lye, sulphonated mineral oils, etc., are employed. For the carrying out of polymerisation of emulsions, emulsifiers, catalysts, protective colloids, and plasticising agents are used, and different substances have been proposed to change the surface tension.

As catalysts, oxidising substances, such as hydrogen peroxide, perborate, perchlorate, persulphate, peroxide, ozonide, and also salts of the heavy metals show that different valencies can be used. Halogen derivatives have also been proposed, such as carbon tetrachloride, trichloracetate, choralhydrate, and the like, which accelerate the speed of polymerisation, and improve the output and plasticity of the rubber product. The use of colloids in polymerising emulsions has also proved of value; these function to stabilise the emulsion. Among other colloids, gelatine, glue, milk,

dextrine, and starch are used, with the result also of shortening the time for hot polymerisation. Finally, the addition of electrolytes and softening agents is found to improve the plasticity, the workability, and in many cases also the strength, of the product. Suitable electrolytes are calcium caseinate, sodium sulphate, sodium bisulphate, potassium idodide, and also acetic and phosphoric acids.

Addition of albumen further shortens the polymerisation process, while oils act on special types of products to increase their acceptability for filling materials. Two examples taken from patent specifications of the I.G. Farbenindustrie A.G. are as follows: (1) 150 parts by weight of butadiene, and 15 parts of hexachlorethane, are emulsified in a solution of 15 parts of stearate, in 150 parts of water; at ordinary or slightly higher temperature a quantitative yield of artificial rubber is obtained in 5 days. (2) 200 parts of butadiene, 90 parts of milk, 4 parts of glue, 4 parts of metylcullulose, 2 parts of sodium butylnaphthaline sulpho-acid, 1 part of sodium isopropylnaphthalene sulpho-acid, 4 parts of castor oil ane 1 part of urea-hydrogen superoxide are heated for 7 days at 50—55° C. The product yield is quantitative, and the product itself is stable and white in colour. Without the urea-hydrogen superoxide addition, the yield is only about 20 per cent., while in the first example, the yield is only about 45 per cent. without the addition of the chlorine derivative.

Step-Like and Mixed Polymerisation

Between the processes described above are a number of mixed processes with which special effects are sought. By a step-like polymerisation, products are obtained of particular suitability for given purposes. According to one example, are in an I.G. Farbenindustrie patent, 40 parts of isoprene with 3 per cent. sodium are treated at a temperature of 35° C. until a highy viscous liquid is obtained; this is dissolved in 70 parts of isoprene and emulsified in 70 parts of a 10 per cent. oleate solution and polymerised at 60° C. Mixtures of dienes are subjected to polymerisation and not only such, but dienes mixed with other substances with a tendency to polymerise. The I.G. Farbenindustrie has protected by patent the treatment of 2 parts of butadiene with 1 part of styrol, emulsified in a suitable solution, with a glue addition in the presence of 0.01 part of carbon tetrachloride. This mixture, heated for 5 days at 55° C., yields a solid plastic product which is a good soft rubber. Using a saponin solution with 0.1 per cent. carbon tetrachloride, and heating at 60° C. for 8 days, a yield is obtained which is less suitable as a soft rubber, but is very useful for many other purposes. Polymerisation in the presence of rubber latex results in a good product. For example, butadiene mixed with an equal weight of latex and polymerised with hyrdogen superoxide at a temperature of 75° C. yields a product which, after vulcanising, has an extensibility of 700 per cent. The above examples indicate the many possibilities in this field, and how, by different operating conditions and additions, quite different types of synthetic rubber may be obtained with mechanical, chemical, and electrical properties not possessed by natural rubber.

To the variable operating conditions belong also high pressures, which exercise a favourable influence on polymerisation. Between 3,000 and 12,000 atmospheres pressure a considerable acceleration of the polymerisation is obtained, depending very much on the previous treatment of the raw materials. For example, isoprene into which ozonised oxygen has been previously introduced, is polymerised to the extent of 88 per cent. in 5 hours under a pressure of 12,000 atmospheres, but the product has no great elasticity. If the pressure polymerisation is carried only so far as to obtain 30 per cent. polymerised, and this is separated from the unchanged material, a very elastic and dense material is obtained with the normal properties of natural rubber.

Synthetic rubber is greatly improved in properties by suitable filling. While the vulcanised artificial rubber without addition of carbon black possesses extensibility of 15,000 to 40,000, the same product into which 30 to 80 per cent. of its weight of carbon black has been incorporated, has an extension value of 50,000 to 190,000. A further example, also taken from a patent specification of the I.F. Farbenindustrie, is still more striking as to the effect of filling. A mixture of equal parts of butadiene and isoprene polymerised products with 15 per cent. zinc oxide, 3 per cent. sulphur, 2 per cent. stearic acid, 2 per cent. tar, and 1 per cent. diphenylguanidine, yields a product, which after vulcanisation, has a tensile strength of 30 to 50 kg. per sq. cm. and an extensibility of 300 to 500 per cent. When the same mixture is worked with 50 parts of the carbon black, the vulcanised end-product has a tensile strength of 180 to 200 kg. per sq. cm. and an extensibility of 600 to 800 per cent.

Chloroprene and Duprene

Mention may be made of the American synthetic rubber known as Duprene, developed through the investigations of Neiuwland into the derivatives of polymers of acetylene. This investigator was killed in studying an acetylene derivative very sensitive to explosion, but he had already observed that by conducting acetylene through a cuprous chloride solution, liquid polymers of acetylene were formed of which the tri-polymer divinylacetylene ($CH_2=CH.C=C.CH.=CH_2$) was the easiest to obtain. This yields by polymerisation clear, colourless gum of high chemical stability.

Under certain conditions the di-polymer vinylacetylene is obtained in good yields, and by introducing a hydrochloric molecule into this, the product is chloroprene, which, like isoprene, yields a rubber product, and in the presence of the chlorine atoms, is much quicker polymerised than isoprene. In some respects this process differs from polymerisation processes described. It proceeds in steps, and leads in the first place to a product which, like raw natural rubber, can be rolled and filled. This initial polymerisation, when continued to an end condition, which is not more workable but resembles in properties an already vulcaised product and is like soft rubber. It has a tensile strength of about 140 kg. per sq. cm. and an extensibility of about 800 per cent. The conversion from the first stage to the end stage is effected without sulphur but nevertheless is very like the vulcanisation process. The process can be accelerated and also slowed down by appropriate additions; the latter is important if the process is used to produce a first-stage product. The end product known as Duprene, is manufactured in different types. The small tendency to swell, and also its resistance to oxidation, is due to the good protection given by the introduction of anti-oxidation agents.

Irish Free State Imports

Figures for First Seven Months of 1936

THE following quantities and values of chemicals, drugs, perfumery, dyes and colours were imported into the Irish Free State during the seven months January-July, 1936:

Acids, 14,524 cwt. (£14,466); calcium carbide, 5,198 cwt. (£3,504); chemical food preservatives and flour improvers, £41,739; copper sulphate, 3,140 tons, (£42,757); disinfectants, etc., 8,575 cwt. (£26,972); potassium compounds, 3,949 cwt. (£6,291).

Sodium compounds: Carbonate in crystalline form, 455 cwt. £210); caustic, 26,402 cwt. £9,277); other sorts, 135,563 cwt. (£57,469); cream of tartar, 1,478 cwt. (£4,859).

Other chemical manufactures and products, £103,178.

Perfumery, cosmetics, etc., £17,373; medicines and medicinal preparations, £159,745.

Dyes, dyestuffs and tanning materials: For dyeing, 12,880 cwt. (£24,738); for tanning, 42,811 cwt. (£29,507).

Painters' colours and materials: Paints, distempers and enamels (liquid and paste, 8,390 cwt. (£25,004); lead, white (including stiff paste), 11,684 cwt. (£25,130); ochre and earth colours, 7,775 cwt. (£8,192); other descriptions, 45,588 cwt. (£47, 558).

High Pressure Chemical Industries in Japan*

By YOSHIKIYO OSHIMA

THE first synthetic ammonia plant in Japan was started in 1923 at the Nobeoka works of the Japan Nitrogen Fertilisers Co. This plant consisted of two sets of the Casale apparatus and the total annual capacity was 10,000 tons of ammonium sulphate. This plant at that time was the largest using the Casale system in the world. Hydrogen in this plant was solely prepared by electrolysis, and nitrogen by fractionation of liquid air produced in a Claude machine. The success of this scheme induced the company to extend its works and remodel its Minamata works where ammonium sulphate was being made by decomposing calcium cyanamide with steam, in a 14-ton apparatus. The same system was later applied at the nitrogen plant at Konan, Chosen, of the Chosen Nitrogen Fertilisers Co. (a sister company of the aforesaid company), the capacity of which is over 400,000 tons.

The Claude process was first taken up in 1924 by the Suzuki concern, and in 1930 by the Mitui concern. The capacity of the latter was at first 50,000 tons, but is now expanded to 150,000 tons of ammonium sulphate. Hydrogen was made by the former firm by fractionating water gas, while the latter utilised the fractionation of coke-oven gas.

The Fauser Process

In 1928, a plant employing the Fauser process was erected by the Japan Artificial Fertilisers Co. at Toyama, where cheap electric power is available. The same process was adopted by the Ube Nitrogen Industries Co., and more recently by the Japan Soda Co.

The Sumitomo Chemical Industries Co. erected a plant at Niihama in 1931, using the N.E.C. (Nitrogen Engineering Corporation) process which was originated in Germany and developed in the United States. This was the first plant which adopted the conversion method for the preparation of the hydrogen.

Two other companies were founded in 1933, both using the Uhde process. The one is the Yahagi Industries Co., the plant of which is situated in Nagoya, a big hydro-electric centre, and the other is the Manchuria Chemical Industries Co. at Dairen. The former company prepares its hydrogen by electrolysis and the latter prepares it from coal. Another company which entered the industry in 1931 is the Showa Fertilisers Co. This company utilises a patent owned by the Government and developed by the former Nitrogen Research Institute.

Decrease in Working Pressure

In looking back over the development of this industry, there are several interesting points, two of which may be specially mentioned. First, the working pressure in the initial period was very high, compared with the Haber process, namely, 700 atm. in the Casale and 1,000 atm. in the Claude process, but recently it has become lower, namely, 300 atm. in the Fauser and even 150 atm. in the Uhde process. This depression of the working pressure has stimulated home producers to construct the compressors and catalytic chambers as well. All the machines and apparatus, except the Linde air machine of the last-mentioned company, for example, have been supplied exclusively by Japanese makers.

The trend of the method of hydrogen preparation is interesting. In early days, most of the enterprises did not pay much attention to the coal-hydrogen process which then prevailed in Europe, but the electrolytic method alone was taken up without discussion. This is not only because cheap electric power was available, as the first firm, the Japan Nitrogen Fertiliser Co., having long been engaged in the manufacture of ammonium sulphate by means of calcium cyanamide and steam, had to utilise its abundant hydro-electric power. It was thus freed from the difficulties implied in the purification of hydrogen prepared from coal or coke, and its engineers were able to concentrate on the high-pressure practice of the new method which was then quite unknown. The comparatively rapid development of the synthetic ammonia industry in Japan must undoubtedly have been fostered by this situation.

In 1931, the Sumitomo Chemical Industries Co. started a plant using the coke water-gas process, and the Mitui concern used coke-oven gas in conjunction with the Linde-Bronn system. The coal-hydrogen process has since been taken into consideration and some of the companies which used electrolytic hydrogen are changing to the water-gas process. The relative economy of the electrolytic compared with the coal or coke process cannot be easily determined as it depends chiefly upon local conditions. It is interesting, however, to cite costs in favour of coal hydrogen as published by Mr. Miyano, of the Showa Fertiliser Co., which is now working with both systems in combination.

COMPARATIVE COST PER TON OF AMMONIA

I. ELECTROLYTIC PROCESS.

	Required.	Unit Cost	Total Cost
Hydrogen	2,250 cu. m.	Sen 3.91	Yen 87.98
Nitrogen	750 ,,	,, 0.23	,, 1.73
Catalyst	—	—	,, 0.30
Power	1,250 kW.-hr.	,, 0.65	,, 8.13
Salaries, wages ..	—	—	,, 1.50
Repairs, maintenance, etc. ..	—	—	,, 3.00
		Total	,, 102.64

II. COAL PROCESS.

	Required.	Unit Cost.	Total Cost.
Hydrogen and nitrogen ..	3,000 cu. m.	Sen 1.72	Yen 51.57
Catalyst	—	—	,, 0.30
Power	1,250 kWh.	,, 1.0	,, 12.50
Salaries, wages ..	—	—	,, 1.50
Repairs, maintenance, etc. ..	—	—	,, 3.00
		Total	**,, 68.87**

Electrolytic power, 5,600 kW.-hr. at Sen 0·65 per 1,000 cu. m. of hydrogen. Coal at Yen 6·00 delivered works.

Synthetic Methanol

Synthetic methanol constitutes another important high-pressure chemical industry in Japan. When the first cargo of synthetic methanol reached Japan from Germany in 1924 there was much discussion about the cost of production of this new product, because of its purity and its low price, *i.e.*, over 25 per cent. cheaper than the market price at that time.

After an investigation of the process made by the Nitrogen Research Institute, it was then taken up by a corporation formed jointly by several firms to develop it at a scale of 1 ton per day. During the investigation, however, two independent companies started plants in 1932, one the Chosen Nitrogen Fertilisers Co. and the other the Tokyo Methanol Co. The former obtained the licence of an Italian patent (Soc. Italiana Ricerche Industriali) and erected a plant at its Eian works, where the largest low-temperature carbonisation plant in Japan is situated. The latter installed the process of the I.G. Farbenindustrie at a plant near Tokyo. These two firms transform most of their product into formalin. The Eian plant prepared the required gas mixture by the gasification of semi-coke produced in its carbonising plant on the Lurgi system, whilst the Tokyo Methanol Co. uses water gas and the iron-steam reaction in parallel.

The Synthetic Industries Co., which is the successor of the corporation mentioned above, started a plant near Shimonoseki to develop its own process. This company also obtained

*** From a paper presented at the Chemical Engineering Congress, London, 1936.**

a licence for the process of the Du Pont Co. and in now manufacturing synthetic methanol using a gas mixture obtained by the water-gas process. This company has a combined plant making synthetic ammonia and methanol. In the methanol section, water gas is first made, and part of the carbon monoxide in it is converted into hydrogen to provide a suitable ratio of carbon monoxide and hydrogen. This gas is passed into the first catalytic chamber working under 300 atm. and methanol is formed which is separated by cooling, the remaining unreacted gas being recirculated.

As the initial water gas contains 7 to 8 per cent. of nitrogen, which tends to accumulate in the circulating gas, a part of it has to be purged in order to maintain favourable working conditions. Keeping the nitrogen content in the purge gas at 20 to 25 per cent., it is mixed with the blow-gas of the water-gas operation and the greater part of the carbon monoxide in the resultant gas is converted into hydrogen. The converted gas mixture is then passed into the second methanol chamber working under 1,000 atm., where the remaining carbon monoxide is converted into methanol. The exit gas from the chamber, consisting of a suitable mixture of nitrogen and hydrogen, is passed into the ammonia section working on the Claude system. This plant can produce 1,500 tons of methanol and 1,000 tons of ammonia per year.

The present capacity for the production of synthetic methanol thus totals about 5,000 tons per annum, whereas the demand is estimated at a little over 6,000 tons. Another plant is under construction by the Sumitomo Chemical Industries Co. and imports will no longer be needed after next year.

Compressed and Liquefied Gases

The first compressed-oxygen plant was started with the Linde machine in 1909, and the Claude system was applied the year after by a French company which was later reorganised into a joint Franco-Japanese company.

During the war, the oil-hardening industry developed considerably and when the by-product oxygen from electrolytic hydrogen was put on the market, it was much appreciated on account of its high purity, compared with that formerly produced by the liquid-air process which was about 95 per cent. pure. Some years after the war, by-product oxygen became available from synthetic ammonia plants, electrolytic as well as air-oxygen.

As it was found uneconomical to transport by-product oxygen for long distances, a rapidly increasing demand all over the country made it necessary to build adequate plants near consuming centres. Accordingly, many plants have been constructed, and there are now 57 plants, the total production in 1934, including by-product oxygen, being reported to be over 35 million cu.m. The machines in use are mostly the Claude, Linde and Hylandt. The gas is now over 99 per cent. pure, and the filling pressure is exclusively 150 atm.

Transport of liquid oxygen in Hylandt vessels is being conducted by the Hodogaya Soda Co. between the works and distribution stations for compressed oxygen, where the cylinders are filled without a compressor, *i.e.*, by the regulated evaporation of the liquid.

The production of compressed hydrogen at present is rather small, compared with that of some ten years ago. It amounted to a little over 750,000 cu. m. in 1934. The hydrogen is mostly a by-product of the electrolytic soda plants. The Tohoku Imperial University has a liquid hydrogen plant on the Hylandt system which is solely used for research work.

Liquid chlorine was first put on to the market by the Hodogaya Soda Co. in 1917, which prepared it in its electrolytic soda plant. The demand for this commodity was then very poor, and it was used to sterilise water as an experiment.

A rapid increase in the production of electrolytic soda in parallel with the startling progress of the rayon industry since 1920 made the disposal of by-product chlorine rather difficult, as the demand for bleaching powder did not increase accordingly. The companies concerned were faced with overproduction of chlorine, and some of them transformed it into synthetic hydrochloric acid, chlorinated solvents, dyes and intermediates, but none of them was able to dispose with success of the ever-increasing output of chlorine. A new use of chlorine in the manufacture of rayon pulp as well as in paper mills in place of bleaching powder, however, promised a bright future for liquid chlorine. The recent increase in sales can be readily seen from the fact that supplies in 1930 were only 700 tons against over 7,000 tons in 1935.

Liquid chlorine was formerly prepared chiefly by compression, under a pressure not exceeding 15 atm., and it could not be produced cheaply on account of the high cost of repair. Lately, change has been made to the deep cooling method, requiring but a small pressure, namely, a little over that necessary to pass the gas into the refrigerator, and thus the cost of production has been much reduced.

Liquid Carbon Dioxide

The present production of liquid carbon dioxide amounts to 3,000 tons per year, and there are 8 plants. There are three sources of the gas, namely, that produced specially by burning coke, the brewery by-product and the by-product from a synthetic ammonia plant where hydrogen is made by conversion of carbon monoxide with steam. Only one plant makes "Dry-Ice," and its carbon dioxide is prepared from combustion gas produced by a special coke-burning furnace.

Anhydrous ammonia had for many years been imported. The first liquid ammonia, though small in quantity, was prepared in 1920 by simple cooling of a concentrated gas produced by decomposition of calcium cyanamide with steam, without any compressor, but only under the generating pressure. Regular production followed after the establishment of the first synthetic ammonia plant at Nobeoka, and there are now 6 plants, the total output being estimated at 15,000 tons per year.

Liquid ammonia is chiefly used for refrigerating, and also for the preparation of ammonium salts other than sulphate. Its increasing use for making nitric acid and urea, however, cannot be overlooked. Five synthetic nitric acid plants are now in operation, and one which uses the Hoko process produces acid of 98 per cent. concentration in one operation. Because of the increasing demand, anhydrous ammonia is now transported by rail in cars of a capacity usually of 10 tons each.

Regulations for Compressed Gear

The present regulations for compressed and liquefied gases were put into force in 1923, and they are partly applied to the high-pressure chemical industries as well. The specification and testing of the containers are dealt with in the regulations. All cylinders except those for liquid ammonia and dissolved acetylene are to be of seamless steel. The chemical composition of the steel is not defined, and the chief details of testing are roughly the same as those in foreign countries. The test pressure for compressed gas cylinders is defined to be not less than 1⅔ times the charging pressure corresponding to a temperature of 35° C.

Containers are not allowed to be used unless they are accompanied by the certificate showing they conform to the flattening and elongation tests. The cylinders which have passed the specific period after the hydraulic test are not permitted to be used. The regulations also include detailed instructions for filling, handling and transportation of the cylinders.

The regulations require every plant which manufactures compressed and liquefied gases to appoint at least one full-time chemical and mechanical engineer. The determination of the qualifications of the engineers is entrusted to the local authority, and a certificate, effective throughout the Empire, is issued to an applicant who passes the examination. In this qualification, great importance is attached to the practical experience of the applicants, hence even university graduates are not allowed to take the examination before less than one year after graduation.

Death of Mr. F. T. T. Reynolds

A Founder of the Chemical and Dyestuffs Traders' Association

MR. Frederick T. T. Reynolds, J.P., formerly of Trafalgar Road, Birkdale, Lancs., died at the Cheadle Royal Hospital on Tuesday.

He was well known in Manchester, where for upwards of fifty years he had been connected with Millwards Merchandise, Ltd., one of the oldest chemical merchanting firms in the country, of which he was chairman and governing director at the time of his death.

Mr. Reynolds was one of the founders and first chairman of the Chemical and Dyestuff Traders' Association, which was formed in 1920 by a number of important and old-established firms of chemical mechants in the United Kingdom, with a view to providing a medium for collective action in safeguarding their mutual interests under the abnormal conditions existing at that time.

Upon the formation of the present British Chemical and Dyestuffs Traders' Association as the result of the amalgamation of the old association with the British Chemical Trade Association, Mr. Reynolds became a vice-president, and in 1927 acted as chairman of the association.

The advent of ill-health, however, unfortunately prevented him from continuing the more arduous duties of chairman, but he took a very keen and active interest in the association's affairs until the time of his death.

He was Mayor of Southport in 1911-12 and was a member of the Southport Town Council from 1910 to 1913. He was made a Southport borough magistrate in 1917. A former chairman of the Southport Liberal Association, he took a prominent part in Parliamentary elections for many years.

Mr. F. T. T. Reynolds.

Mr. Reynolds travelled widely in India and Russia, and he was an ardent worker in the cause of Free Trade.

Increasing Dye-Fastness by Chemical Auxiliaries

By "CHEMITEX"

ALTHOUGH the number of fast dyes available to the dyer is very large and presents a considerable choice of colours, there are still occasions when he must have recourse to subsidiary processes which increase the fastness of the dyeing after the colouring matter has been applied to the fibre. The present-day popularity of composite fabrics composed of two or more natural or artificial threads puts an added restriction on the dyer's choice of suitable dyestuffs. It does not always happen that colour requirements and fastness requirements are satisfied by the same combination of dyes.

During the last few years there has been a growing interest in the use of urea and thiourea as a means of increasing the fastness of dyeings on cotton, cellulose acetate and silk; particularly have they been recommended in colour-printing textiles. Brit. Pat. 406,653 describes the application of thiourea to anthraquinone dyeings on acetate rayon, and states that by steaming the thiourea may be fixed on the fibre and thereby render the improvement permanent.

Many attempts have been made to increase the fastness to light of dyeings by impregnating the coloured fabric with some chemical which does not transmit the reactive rays of the solar spectrum. Thus it has been stated that the application of aromatic amines to acetate silk improves the light-fastness due to the fact that the presence of such bodies constitutes a light filter. Dimethylaniline has been patented in America. It is very questionable whether leaving compounds in the fibre after dyeing is desirable, both from the point of view of cost and of wear, especially if they be of an irritant nature.

For the dyeing of cotton and viscose rayon, the dyer may use either substantive dyes which are applied very simply from a neutral salt bath, or he may use the vat dyes from a bath of hydrosulphite or other reducing agent, a much more complex process. Unfortunately for the substantive dyes, though they are now made of considerable fastness to light, even approaching and sometimes equalling the fastness of the vat dyes in this respect, they are a long way inferior to the vat dyes in fastness to water and washing. Considering the ease of applying the substantive colours and the corresponding lower cost of dyeing, it is not surprising that other means of increasing the fastness to water have been sought, including all manner of after-treatment processes.

A prolific patent literature has grown round the use of substituted ammonium compounds and pyridine derivatives. An early patent of the Society of Chemical Industry in Basle describes the after-treatment of cotton dyed with Cotton Yellow CH, with a solution of octadecyl-diethylamine hydrochloride, whereby improved fastness to water is obtained. Compounds of this class, when dissolved, give an ion of opposite electrical charge to that of the dye molecule and probably bring about an irreversible precipitation inside the interstices of the fibre. Imperial Chemical Industries, Ltd., refer to the use of actadecyl pyridinium bromide in 0.1 per cent. aqueous solution for after-treating colourations on cotton produced by Chlorazol Fast Red K. The treated yarn is rendered faster to water, perspiration and cross-dyeing.

Brit. Pat. 435,868 of the Calico Printers' Association deals with the application of a mixture containing urea, ammonium acetate and formaldehyde after reaction has proceeded for 30 minutes, to rayon fabric previously dyed with Chlorazol Fast Scarlet 4BS. The treated dyeing withstands washing in boiling soap solution. There would appear to be a very promising future for the synthetic resins in dyeing if we are to judge by this interesting example.

Glass Bottle Manufacture at Charlton

The Works of United Glass Bottle Manufacturers, Ltd.

THE photographs reproduced on the opposite page show certain aspects of glass bottle manufacture as seen by the delegates to the Chemical Engineering Congress when they visited the Charlton Works of United Glass Bottle Manufacturers, Ltd.

Formed in 1913 for the purpose of amalgamating several well-known bottle manufacturing businesses which had all been in existence for a period of between fifty and a hundred years, United Glass Bottle Manufacturers, Ltd., have a very modern plant at Charlton. This plant, which started operations in 1920, was specially constructed for the operation of the well-known Owen's bottle machine, and has incorporated in it every possible mechanical means that can be employed throughout the whole of the various operations involved, from the handling, storage, mixing and distribution of the raw materials, the operation and regulation of the furnaces, the manufacturing and annealing of the bottles, down to the sorting and shipping of the finished product. In addition to the installation of modern automatic machinery every facility has been provided in the factory and in the general organisation to obtain the maximum possible efficiency, economy and service. The total area of the site occupied by the works is 33 acres.

Drying the Sand

All sand used for glass making is dried before use by means of a rotary sand dryer, which is coke fired, and has a capacity of approximately 8 tons per hour. Sand is brought in railway wagons and dumped into a hopper, and is then elevated and passed through the dryer, and is again elevated and passed back into the railway wagon for transmission to the batch plant.

The batch plant consists of six ferro-concrete bins or silos of 700 tons capacity each, together with batch cars, elevators, conveyors and mixers. The raw materials such as sand, lime, soda ash, etc., are brought along in railway trucks and elevated into the bins, a screw conveyor running along the top of the bins distributing the raw materials into their respective bins. Underneath, for the full length of the batch bins, is a track on which runs an electric travelling batch car. This car collects and automatically weighs the different raw materials and cullet from the underside of the bins, each bin having a valve or gate which on being opened allows the raw material to fall into the travelling car. The car then delivers the raw materials to the batch mixer. Another electric travelling car then collects the mixed batch and runs on a track over the furnace batch bins.

The Furnaces

In the glass house there are four furnaces of the reversing regenerative type, provided and constructed for either gas or oil firing, and each feeding two Owen's machines. These furnaces, according to "Modern Industrial Furnaces" (Stein and Atkinson, Ltd.), were built to a design patented by the company and known as "Torpedo Shaped." The average melting capacity of each furnace is from 30 to 40 tons per day, although for special periods 50 tons can be melted.

Fuel oil of a calorific value of approximately 19,000 B.Th.U. per lb., which is equivalent to 10,555 calories per kilogram, is fed under pressure direct to the furnaces, and is atomised by compressed air. An improved Cox type burner is used for atomising and burning the oil, the whole system being simple and easy to operate and control, and at the same time being very efficient. The furnaces are built with a dog house of special design to take a modern type of mechanical batch feeder, batch being supplied to the feeders from a large batch bin immediately over them.

The bottle making machines gather their glass from the revolving pots. These are 10 ft. in diameter and are fed with glass from the furnaces through a spout, the rate being controlled by an adjustable plug. The pots are recuperatively fired by a single burner, and the return flue is alongside the air up-take, forming a horse-shoe flame. Seven of the recuperators are constructed of cronite and of carborundum pipes and the other is of the "Stein" type.

As it is essential to keep the temperature of the revolving pots constant, an automatic temperature control is coupled to each burner. This temperature control works on a somewhat improved principle to others. In the usual controls, when the temperature falls to a minimum, increased fuel is turned on gradually, which slowly brings back the temperature of the furnace to normal. In the one used at Charlton, the temperature is restored to its normal immediately.

The Bottle Machines

The bottle machines are the well-known Owen's suction machines, A.N. and A.R. 10-arm types. Bottles of approximately 6 oz. weight and under are manufactured on the A.N. type, and larger sizes on the A.R. type. As already stated, there are two machines to each furnace, each machine having its own revolving pot and recuperative furnace. In laying out the plant, great care was paid to having these machines easily accessible, there being a platform running the full length of the machine shop uninterrupted by any machinery.

Situated over the bottle machines is a travelling crane which runs the full length of the shop, and which can travel through the gable end wall of the building over the railway lines adjoining the batch plant. The crane can pick up any material or machine parts straight from the railway wagon and place them in the shop in any position necessary. It is also used for changing the type of machine at any furnace, a necessity which often arises from the manufacturing programme.

The lehrs are of the all-metal slag-wool insulated type, with the woven wire mattress belt, now known as the "Charlton" lehr. It is actually heatless over average loadings of from 12 to 36 tons of glass annealed per day. In order to deal with the heavier loads, special cooling facilities are provided at both the hot and cold ends of the lehr, and for loadings under 12 tons a 15 kW electrical heating installation is provided to supply the extra heat which is usually required.

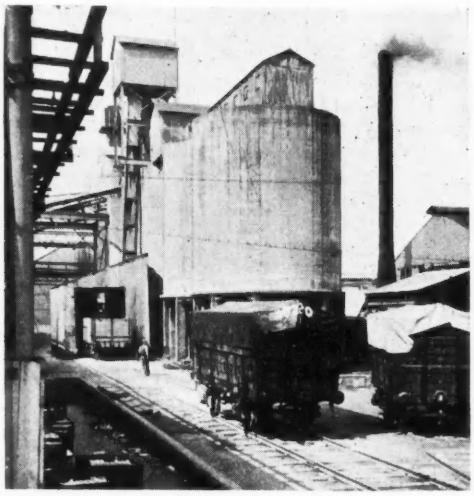
The insulation of the various zones of the lehrs has been so graduated that adjustments to the rate of cooling are reduced to the absolute minimum, assuming the correct temperature at the start of the annealing zone is obtained. All the lehrs are fitted with an automatic loading mechanism, reducing labour and the human factor in handling and annealing to the minimum.

In a portion of one of the warehouses is a washing and sterilising plant for treating medical bottles. They are carefully washed and sterilised and packed in cartons, and so delivered to customers that they may fill them forthwith without further cleansing. There is also a building for acid etching and sandblasting special types of bottles.

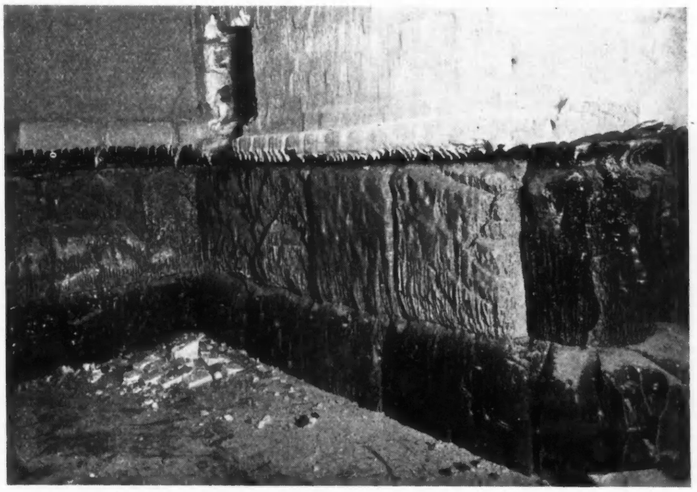
Power House Equipment

The power house is a combination of a boiler room and an engine room. In the boiler room there are installed two Babcock and Wilcox water tube boilers, each rated to evaporate 12,000 lb. of water per hour at a steam pressure of 160 lb. per sq. in. Each boiler is equipped with a forced draught chain stoker, 6 ft. 6 in. wide and 10 ft. long. The fuel is brought by railway wagon and deposited by a mechanical rotary unloader into an adjacent receiving hopper. A reciprocating feeder located under the hopper passes the

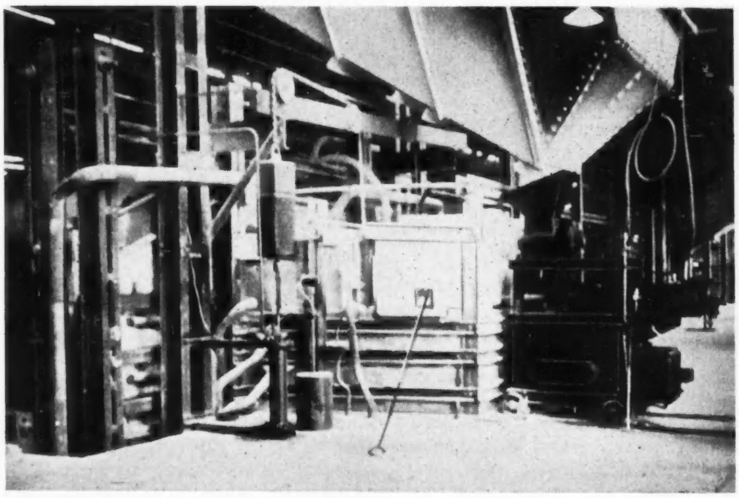
Glass Bottle Manufacture at a London Works



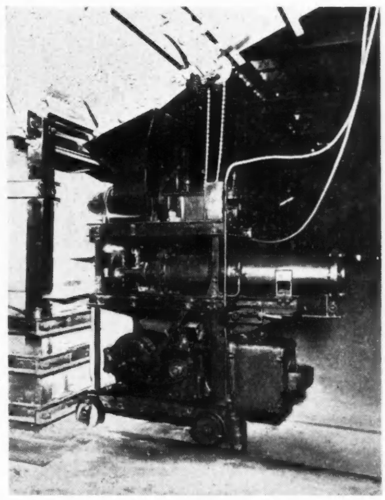
The " batch " storage and mixing plant consists of six ferro-concrete bins or silos of 700 tons capacity each, together with batch cars, elevators, conveyors and mixers.



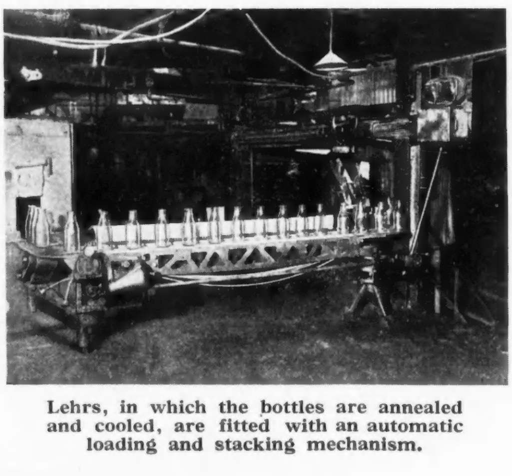
Interior view of corner of the refining tank of one of the continuous melting furnaces showing upper row of Sillimanite blocks.



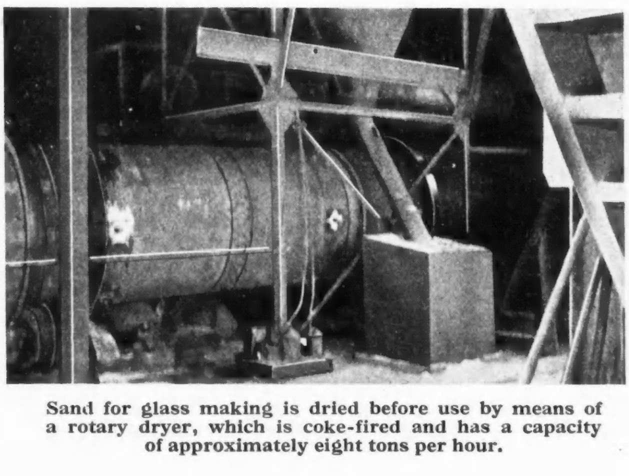
Side view of automatic " batch " feeder for one of the continuous tank furnaces. " Batch " is supplied to the feeders from a large " batch " bin immediately above them.



Close-up view of one of the automatic " batch " feeders.



Lehrs, in which the bottles are annealed and cooled, are fitted with an automatic loading and stacking mechanism.



Sand for glass making is dried before use by means of a rotary dryer, which is coke-fired and has a capacity of approximately eight tons per hour.

coal to a short belt conveyor which feeds the coal to a continuous bucket elevator. This deposits the coal on to another belt conveyor, which empties into a coal bunker above the boilers. From the bunkers the coal flows by gravity to the stoker hoppers.

The gases from the boilers are discharged through an induced draught fan to a brick chimney 60 ft. in height. The feed water for the boilers is first softened in a "Lassen Hjort" lime soda softener, from there it is fed to a Worthington-Simpson atmospheric type heater from which the feed pumps take their supply and deliver to the boilers. The boilers are equipped with steam flow meters and CO_2 recording apparatus by which the steam supplied by the boilers is measured and the waste gas analysed, so that the efficiency of combustion is constantly under observation.

In the corner of the boiler house at the back of the boilers are situated the oil fuel pumps which supply oil to the furnaces. These deliver the oil from the main storage tank to the working tank which feeds the fuel oil to the burners. The oil fuel supply is stored in five tanks holding approximately 2,000 tons, it being pumped direct into these from the barge at the company's wharf.

The machinery in the engine room is used to compress the air for atomising the oil at the burners, also to supply blowing air for the bottle machines. There are also three vacuum pumps for the glass bottle machines, two of these being in continuous operation, the other one being spare. The equipment comprises two steam-driven cross-compound condensing, direct connected, single stage, air compressors, each designed to compress 1,650 cu. ft. of free air per minute at a gauge pressure of 30 lb. per sq. in. There is also one electrically-driven air compressor and two steam-driven cross-compound condensing, direct connected vacuum pumps, and one rotary vacuum pump, each with a displacement of 3,200 cu. ft. per minute.

Water for industrial use at the works is obtained from the three boreholes situated inside the works, two being 18 in. inside diameter, and the other 14 in. inside diameter; all are approximately 300 ft. deep. In each of the boreholes there is installed at a depth of 135 ft. a three-stage centrifugal pump driven by a vertical shaft from above. The pump is supported by a column of 7 in. piping through which the water is discharged to the surface. At the surface of the ground a single stage vertical spindle pump is installed and driven by the same shaft as the one below, making in all four stages, three in the borehole and one on the surface.

Recovery of Gold from the Sea

By GROVE JOHNSON, F.C.S.

THERE is much reliable data available to prove that gold is present in the sea. There remains, however, the important question—can its recovery be accomplished on a payable basis? It is profitable to recall the work of a few investigators who were (or are) eminent men whose research and opinions are worthy of consideration. I believe Sonstadt was the first pioneer who proved the presence of gold in the water around the Isle of Man, but I do not remember whether he endeavoured to extract it. His analytical notes are of the very highest interest and his reasoning undoubtedly sound. Next on my list comes Professor Liversidge, of Sydney University. He erected a plant off the New South Wales coast, his idea being that the tide would fill his tank and so save the cost of pumping. But this contemplated economy in handling the water was of no effect for the reason that an unusually high tide washed the plant away. I think he used ferrous-sulphate for his reagent.

The experiments of M. Claudé, a French engineer, were conducted with water from the Gulf Stream. He proved to his satisfaction that the gold content was at least 0.5 grain per ton of water. Then we have Professors Fritz Haber, of Berlin, and Dow, of New York, both of whom have furnished reliable data, but at the same time are doubtful whether any method proposed to date can be made to pay. Professor Dow stated in one of his addresses that he had succeeded in extracting one tenth of a milligram of precipitate—half gold and half silver—from twelve tons of sea water.

So far, then, we have arrived at a *cul-de-sac*, from a practical point of view. But a name well known in the engineering world has not been associated in the public mind with research chemistry. I refer to the late George Duncan, M.Inst.C.E., of Melbourne. As a very young man he laid down the Melbourne cable tramway system, many railways and irrigation plants in Australia. He then went to the States to Study the cyanide process for gold extraction, and returning to Melbourne bought up many "tailing dumps" and recovered the gold. With this experience he set to work to tackle the sea water problem and for 20 years he pursued his researches in all weathers at Black Rock, Melbourne. With what success? If I say he solved the problem without any possible doubt I suppose I will meet the usual incredulity.

I have not told all yet. I met George Duncan in Melbourne by the merest chance—we became great friends and during those twenty years I gave him all the help I could and built myself a laboratory conveniently close to his "works" on the beach, which he always referred to as his "box." Every detail of his work was accurately recorded, and a few days before he died he sent for me (I was in Sydney at the time), and on my arrival he said: "You have all my notes. I hope you can find time to carry on; it would be a thousand pities should all this knowledge be lost."

I returned to London from Melbourne last December and put up a very inadequate plant at Portland, Dorset. My experiments proved all George Duncan's claims. From *half a ton* of water I recovered a speck (assayed by Mr. Claudé, of Coleman Street), not weighable truly, but sufficient to prove the secret of recovery had been solved on a payable basis. My figures show a great advance on Professor Dow's, which I have quoted.

Before his death, Duncan designed a plant to deal with 50,000 tons of water every 24 hours. He estimated the cost of this plant at £10,000, and gold recovery at the rate of one tenth of a grain per ton (which he succeeded in recovering over and over again) would amount to 5,000 grains or roughly 10 oz. of gold, at £7 per oz., amounting to £70 per day gross profit. His experience in pumping vast volumes of water for irrigation purposes drew him to the conclusion that pumping was far better than chancing the loss of plant by turbulent seas.

Can there remain any doubt in anyone's mind that this is not a fairy story; certainly not in mine after following up every detail of the work for 20 years. It can be demonstrated that it is unquestionably true, that Duncan actually solved the problem, and, moreover, proved it on a payable basis. The whole problem resolves itself into one of chemistry combined with engineering, and it was due to full knowledge and experience in both subjects that enabled him to succeed where others failed.

Personally, Duncan was as modest as a schoolboy, and a great idealist. On many occasions he dwelt on the tragedies associated with mines. Anyone who has been to Kalgoorlie must be saddened by the sight of many graves of men who died from the effects of dust from stamp batteries. "What a merciful thing it would be if we could obtain all the gold required, without the danger and the darkness of the mines," was a thought ever uppermost in his mind.

Personal Notes

MR. F. E. TURNER, a director of Yorkshire Indigo Scarlet and Colour Dyers, Ltd., died on September 5, at the age of 51, at Dapper House, Wheatley, Halifax.

MR. GEORGE SAUNDERS SMITH, who was chairman of the London Metal Exchange from 1919 to 1928, and a director of the Bassett Ore and Metal Co., left estate value £112,926.

MR. E. L. B. THOMAS, who has been in the service of Boots Pure Drug Co. for twenty-four years, has been elected to a seat on the board in succession to the late Mr. H. R. Gillespie.

MR. FRANCIS CHARLES LEWIS, of Plumstead, one of the five men killed in the explosion at the Research Department of Woolwich Arsenal in July, left £4,645, with net personalty £4,637.

MR. M. H. THOMPSON, who for many years was analytical chemist with the Veille Montagne Zinc Co., of Nenthead, Cumberland, and latterly was manager of the Spelter Works, Lambley, has died at Benton, Northumberland. At one time, Mr. Thompson was associated with Dunford, Smith and Moor, analytical chemists, of Newcastle.

MISS SYLVIA GALLAGHER, only daughter of Mr. and Mrs. Patrick Gallagher, of Wigan, and Mr. Cyril Rigby, younger son of Mr. and Mrs. Richard Rigby, of Wigan, were married at St. John's Catholic Church, Wigan, on September 1. The bride's father, who gave her away, is managing director of the West End Chemical Works, Wigan.

MR. GEORGE SNELL, a director, agent and general manager of the Wombwell Main Coke and By-Product Co., died on September 5 at his home, Woodleigh, Wombwell, aged 58. He was a member of the South Yorkshire Coal Trade Association, the Midland Amalgamated Coal Mines Committee, and the Midland Institute of Mining Engineers.

MR. EDWIN BARON, aged 62, engineer at the Port Sunlight works of Lever Brothers, Ltd., the first employee to complete fifty years with the firm, has been granted a cheque for £50 and a month's leave with full pay. The presentation of the cheque was made by Mr. J. L. Ferguson, resident managing director at Port Sunlight.

MR. JOHN CAMPBELL, whose funeral took place on Monday from Sheddens Villa, Shettleston, Glasgow, had been associated with the British Dyewood Co., Ltd., Glasgow, and its predecessors for nearly 54 years. He entered the service of McArthur, Scott and Co. (subsequently incorporated in the British Dyewood Co.) at Carntye in 1852. Mr. Campbell was actively engaged in his duties as works manager of the firm until a few weeks before his death, which occurred on September 4.

THE funeral took place at Heaton Cemetery, Bolton, on September 2, of Mr. Arthur H. Chadwick, of Southport, formerly of Bolton. He was well known in the chemical trade throughout the north. For many years he was a director of C. T. Schofield and Co., Ltd., heavy chemical manufacturers, Clayton, Manchester, and later became a partner of the firm of Harrison Blair and Co., Ltd., Kearsley, Lancashire. Latterly he was associated with Hardman and Holden, of Manchester.

MR. JAMES MACLEOD, manager of the Glasgow Corporation Chemical Works Department, who, as reported in THE CHEMICAL AGE of August 15, is due to retire on December 1, has received the official thanks of the Corporation for the services he has rendered during the past 11 years. Previous to taking up his appointment with the Corporation, Mr. Macleod was for a number of years connected with James Nimmo and Co., Ltd., coal masters, in the capacity of manager of the coke-oven and by-products plants at Auchengeich Colliery, Chryston. From 1908 to 1917, Mr. Macleod was the manager of the Greenock Gasworks, and from there he went to Botherton and Co., Ltd., chemical manufacturers, Leeds. He was with that firm for two years.

MR. WILLIAM DENT, assistant chemist at the Templetown Coke Works has been appointed chemist in charge of the manufacture of bituminous emulsions, road materials and lubricants at Ardrossan, Scotland, for J. A. Jobling and Co., Ltd., Sunderland.

SIR PHILIP DAWSON will be installed as president of the Institute of Fuel by Sir John Cadman on October 15 in the meeting hall of the Institution of Mechanical Engineers. The installation will be followed by Sir Philip Dawson's presidential address.

MR. JOHN MCBRYDE, manager at Bathgate Chemical Works, has been presented with a barometer on the occasion of his retiral after 64 years with the company. He had served 40 years in the laboratory at Addiewell and 24 years as manager at Bathgate.

PROFESSOR DR. FRANZ FISCHER, of the Kaiser-Wilhelm Institut, Mulheim-Ruhr, Germany, the Melchett medallist for 1936, will deliver the Melchett Lecture to the Institute of Fuel at the Institution of Mechanical Engineers on October 15, when he will give an account of some of his most recent work on the production of synthetic motor spirit.

MR. SAMUEL B. MCKITTRICK, of South Knighton Road, Leicester, and formerly of Leyland, Lancashire, manager of the South Knighton Dyeworks for 13 years, has died at the age of 57. He was the eldest son of the late Mr. John McKittrick, manager of Leyland Bleach and Dyeworks for many years.

MR. W. S. KERRY has decided, in view of his age, to retire from the presidency of the National Drug and Chemical Co. of Canada, and in his place there has been appointed one of the preference shareholders' nominated directors, Mr. E. G. Jackson. The general manager, Mr. C. H. Lander, has been appointed senior vice-president, while two new directors, Mr. A. H. Elder (a nominated director) and Mr. Ernest E. Lloyd, for many years vice-president (in charge of finances) of the Canadian Pacific Railway Co., have joined the board in place of two other directors who have retired for reasons of age.

Pure and Applied Science

Third Edition of Classification

A NEW third edition of "Classification for Works on Pure and Applied Science in the Science Museum Library" (the Science Museum, South Kensington, or H.M. Stationery Office, price 5s.) is based on the Universal Decimal Classification of the International Institute of Documentation and constitutes an English abridgment of that work.

The Universal Decimal Classification is designed as a means of indexing information, whatever may be its object, source or language, the decimal notation being understood throughout the world and independent of language. In this classification, the whole of knowledge is represented by unity, each class being denoted by a decimal number, whose position in the numerical sequence remains unaltered, no matter how extensive the subdivision of adjacent classes may become.

This Science Library abridgment, while covering the whole of knowledge in outline, develops the science section in greater detail. The number of classes included is about six thousand, to which is added a copious alphabetical index comprising some five thousand entries. The work is intended as a guide to readers in consulting the library subject catalogue and subject index of two million references to periodical literature, and for use with the library's published accessions lists and bibliographies. Its publication will serve to increase the use of the Universal Decimal Classification as a standard bibliographical tool. The abridgment will be of value to specialists for use with the complete classifications of their particular subjects to general and scientific libraries for the arrangement of their books.

The Chemical Age Lawn Tennis Tournament

To-day's Finals at East Ham

GIVEN fine weather there is every prospect of a thoroughly enjoyable afternoon at East Ham to-day (Saturday) on the occasion of the finals of the sixth annual CHEMICAL AGE Lawn Tennis Tournament. By the kind invitation of Sir David Milne-Watson, governor, the finals are to be played at the sports ground of the Gas Light and Coke Company at Southend Road, East Ham. Play is timed to start at 3 p.m. prompt, and visitors are asked to be in their seats not later than 2.45 p.m. Two matches are due to be played, the men's singles and doubles, and in each match the best of five sets will be played unless adverse weather conditions render it necessary to shorten the programme. Tea, by invitation of the Gas Light and Coke Company, will be served after the singles match (approximately 4.20 p.m.) and the doubles match will follow the tea interval.

At the end of the second match, Mr. John Benn, a director of Benn Brothers, Ltd., proprietors of THE CHEMICAL AGE, will present the trophies—THE CHEMICAL AGE silver challenge cups to the winners, to be held for twelve months, the "Invicta" statuettes (given by Thomas Hill-Jones, Ltd.) to the winners, and the "Lloyd Willey" statuettes (given by Mr. W. Lloyd Willey) to the runners-up.

As will be seen from the names of the finalists, each match will be a contest between London and Port Sunlight. Mr. C. C. Gough, of Lever Brothers, Ltd., is playing in both matches. Both he and his partner, Mr. T. P. Williams, are newcomers to the tournament this year. It is not a new experience in THE CHEMICAL AGE tournament for the same player to appear in both singles and doubles in the one afternoon. Last year Mr. J. Haines (Anglo-Iranian Oil Co., Ltd.) took both cups (though actually he had a walk over in the singles on account of a last-minute accident to his opponent). In 1934, Mr. A. Baxter (United Yeast Co., Ltd.), who meets Mr. Gough this afternoon, lost the doubles and won the singles after a gruelling afternoon on which he played no fewer than 61 games. In 1933, Mr. R. G. Pennington (J. Crosfield and Sons, Ltd.) lost both singles and doubles.

In the doubles, Messrs. A. E. C. Willshere and L. F. Grape (Borax Consolidated, Ltd.) are making their second appearance in the final; twelve months ago they were defeated by Messrs. J. Haines and F. G. Hawley (Anglo-Iranian Oil Co., Ltd.) who won the cup for the third time in succession. When the tournament was inaugurated in 1931 no one anticipated the possibility of the same pair winning three years running, and no reference was made in the rules to that contingency. The winners, however, sportingly handed back the cup in order that it might long continue to be the object of friendly rivalry amongst tennis players throughout the chemical industry.

The progress of the finalists through the earlier rounds of the tournament has been as follows:

Mr. A. BAXTER.—1st round, walk over; 2nd round, beat Mr. J. Hudson (Bakelite, Ltd.), 6-3, 6-1; 3rd round, beat Mr. V. D. Thompson (Stafford Allen and Sons, Ltd.), 6-3, 6-3; 4th round, beat Mr. L. F. Grape (Borax Consolidated, Ltd.), 3-6, 6-2, 6-2; semi-final, beat Mr. C. G. Copp (Doulton and Co., Ltd.), 6-3, 6-4.

Mr. C. C. GOUGH.—1st round, bye; 2nd round, beat Mr. C. T. Woodcock (British Tar Products, Ltd.), 6-4, 6-2; 3rd round, beat Mr. E. Pavitt (Co-operative Wholesale Society), 11-9, 3-6, 6-2; 4th round, beat Mr. R. M. O. Williams (Chance and Hunt, Ltd.), 6-4, 6-1; semi-final, beat Mr. A. W. A. Goudie (Tar Residuals, Ltd.), 6-2, 6-4.

Messrs. WILLSHERE and GRAPE.—1st round, beat Messrs. A. A. Killick and G. A. Brittain (B. Laporte, Ltd.), 6-1, 6-3; 2nd round, beat Messrs. A. W. White and R. H. Hornsby (Howards and Sons, Ltd.), 6-2, 6-0; 3rd round, beat Messrs. P. D. O'Brien and F. D. Hand (B. Laporte, Ltd.), 6-0, 6-1; semi-final, beat Messrs. V. J. Prosser and A. Baxter (John Haig, Ltd., and United Yeast Co., Ltd.), 6-2, 6-1.

Messrs. GOUGH and WILLIAMS.—1st round, beat Messrs. E. J. Allday and J. W. Parkes (Bakelite, Ltd.), 6-2, 6-1; 2nd round, beat Messrs. W. Speakman and S. E. Challoner (Monsanto Chemicals, Ltd.), 6-3, 2-6, 6-2; 3rd round, beat Messrs. J. H. Bennitt and J. E. H. Hayward (Bakelite, Ltd.), 6-1, 6-2; semi-final, beat Messrs. R. D. Hayman and C. G. Copp (Doulton and Co., Ltd.), 7-5, 8-6.

There is ample car park accommodation at the East Ham ground. For those not travelling by car the best way to the ground is to take the District Railway to East Ham Underground Station; turn left outside station, take first turning on left (Burgess Road) and first turning on left again (Southend Road). The ground is about five minutes' walk from the station.

THE FINALISTS

SINGLES:

A. BAXTER, United Yeast Co., Ltd.
v.
C. C. GOUGH, Lever Brothers, Ltd. (Port Sunlight)

DOUBLES:

A. E. C. WILLSHERE and L. F. GRAPE, Borax Consolidated, Ltd.
v.
C. C. GOUGH and T. P. WILLIAMS, Lever Brothers, Ltd. (Port Sunlight)

Imperial Chemical Industries, Ltd.

Interim Dividend Unchanged at 2½ per Cent.

THE directors of Imperial Chemical Industries, Ltd. announce that they have declared as at September 12, in respect of the trading year ended December 31, an interim dividend of 2½ per cent. actual on the £43,764,759 ordinary stock, resulting from the conversion into stock of former ordinary shares. This dividend will be payable (less income tax at 4s. 5½d. in the pound, being United Kingdom income tax at 4s. 9d., less Dominion income tax relief at 3½d.) on November 2, 1936, to stockholders on the register on September 12.

The directors further announce that contingent upon the House of Lords upholding the decision of the Supreme Court which confirmed the reduction of the capital, they have declared in respect of the trading year ending December 31, 1936, an interim dividend of 2½ per cent. actual (less income tax at the appropriate standard rate reduced by Dominion income tax relief at 3½d. in the pound) on the £5,434,141 ordinary stock, resulting from the conversion and consolidation of the former 21,736,564 deferred shares of 10s. each, such interim dividend to be payable on a date and to stockholders on the register on a date to be fixed by resolution of the board.

ITALIAN production of mineral acids in 1935 was considerably higher than that of 1934, when sulphuric output totalled 1,238,700 metric tons, basis 50° Be., nitric 209,100 tons, basis 36° Be., and hydrochloric 41,400 tons.

Californian Redwood

Its Resistance to Acids and Alkalies

In his article on the construction of wood tanks in The Chemical Age of August 22 (pages 155-157) Mr. John D. Watson referred to the resistant qualities of Californian redwood, but by mistake described it as "Canadian" redwood. The famous Sequoia Sempervirens—generally known as redwood—is found nowhere except in California, and practically only in three counties of the State. It grows from the edge of the Pacific in a strip from 10 to 30 miles wide, reaching to the western edge of the Coast Range. Redwood trees often have a diameter of 20 ft. at the butt and a height of 350 ft. The majority of redwood trees cut are from 800 to 1,200 years old, but many giants are felled whose ages are from 1,500 to 2,000 years. At the present rate of cutting there is over 150 years' supply of redwood lumber.

Redwood is a soft, straight grained, easily worked wood, varying in colour from a light cherry to a dark mahogany. The number of annular rings in cross section vary from 10 to 50 in an inch. Limbs are seldom found below the upper third of the trunk. The tree contains no pitch or resinous matter, and the wood is difficult to ignite and very slow burning even when dry. The wood contains an acid which renders it immune from insect attack and which is generally accredited with furnishing its admitted immunty from decay. Just what property in redwood gives it the ability to resist destruction by acids and alkalies is not known, but that strong solutions of either acids or alkalies that will quickly destroy metals have no effect on redwood is well known and has been demonstrated in hundreds of cases.

There are redwood tanks in a San Francisco tannery, part buried and part above ground, which were installed in 1859 and have since held acid solution, alkaline solutions and greases continuously. A thorough examination made in 1925 found them to be absolutely free from decay, and they are still in daily use. Similar examples of the endurance of redwood tanks and pipe can be found all over the Pacific Coast.

Letter to the Editor

Chemists in South Africa

Sir,—A statement appears in your "South African Chemical Notes" (The Chemical Age, May 23, 1936), in connection with a visit of Mr. Alfred Ridout, of J. Grossmith and Son, Ltd., London, to the Union of South Africa, that "more industrial chemists seem to be available in Natal than in any other part of the country."

It is difficult to know on what grounds this statement is based, in view of the fact that the largest universities in the Union are the University of the Witwatersrand with 2,200 students, and the University of Cape Town with 2,000 students, both institutions being actively engaged in the training of industrial and chemical students.—I am, Sir, yours faithfully,

Henry Stephen,

Head of the Department of Chemistry and Chemical Engineering. University of the Witwatersrand—Transvaal, University of Cape Town—Cape Province.

Johannesburg,

August 25, 1936.

Chemical Notes from Foreign Sources

Germany

The old-established firm of Dr. L. C. Marquart A.G., producing a range of metals and metallic salts, has been merged with the Deutsche Gold- und Silber-Scheideanstalt.

Russia

Extensive antimony deposits with a reported antimony content of 12.3 per cent. have been located near Birakan.

A range of luminous pigments, including those with blue, green, yellow and orange tones, is to be made by processes recently developed on the laboratory scale.

Siam

Japanese interests are strongly represented in a new sugar-producing enterprise with a planned annual output of 40,000 tons. One-half of the capital has been invested by the Japanese Association of the Sugar Industry, and one-quarter each by the Siamese Government and a group of Siamese industrialists.

Switzerland

Increased demand for artificial precious stones for technical purposes is reported by the Swift Jewel Co. S.A., of Locarno.

Recently registered companies include: Galiena S.A., Lausanne (capital 5,000 francs), pharmaceutical preparations and foodstuffs; Pharmedica A.G., Zurich (capital 20,000 francs), perfumes, foodstuffs and pharmaceuticals; Nitro-Color-A.G., Basle (capital 5,000 francs), nitrocellulose lacquers; Teeracco A.-G., Lucerne (capital 170,000 francs), tar and bitumen emulsions for road making.

Italy

In connection with the proposed "casein-wool" factory of the Snia Viscosa at Cremona, it has been decided by the Produttori Latti di Cremona to build a casein plant at Dosimo with a daily capacity of several tons skim milk.

Sweden

According to press reports technical equipment has been completed of the new Nörrkoping viscose and cellulose acetate factory of the Nordisk Silkcellulosa concern. It is intended to set aside 80 per cent. of the net profits for research work.

Manchukuo

The South Manchurian Railway Co. has decided to utilise the power pant of the Fushun Mines to make calcium carbide ("Chemische Industrie").

With a working capital of 5 million yuan, the Manchuria Oil Industry Co. has been established at Mukden and contemplates operating a coal-hydrogenation plant at Ssupingkai, between Mukden and Hsinking with annual outputs of 12,000 tons benzine, 2,300 tons lubricating oil and 80,000 tons coke.

Japan

Cellulose acetate is now being marketed from the Yamagata works of Tekkosha K.K. (daily output 1.5 tons).

Manufacture of technical chemicals will be undertaken by Meiji Seiyaku K.K. recently formed in Tokio with a capital of 50,000 yen.

A 30 to 40 per cent. expansion in production is planned by Takasago Koryo Kogyo K.K., an important exporter of safrole, heliotrope, vanillin and other perfume raw materials.

Inventions in the Chemical Industry

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Open to Public Inspection

CLEANSING OF RIGID MATERIALS.—Dr. A. Wacker Ges. für Elektro-Chemische Industrie Ges. Feb. 25, 1935. 17521/35.

PROCESS FOR THE PRODUCTION OF MAGNESIUM by the thermal reduction of magnesiferous raw materials.—I. G. Farbenindustrie. Feb. 28, 1935. 28867/35.

RESIN SIZE.—Paper Makers Chemical Corporation. Feb. 27, 1935. 484/36.

PREPARATION OF PIGMENTS for enamels, lacquers, inks, and the like.—E. I. du Pont de Nemours and Co. Feb. 28, 1935. 2305/36.

CHEMICAL SUBSTANCES, particularly for finishing and otherwise treating textile goods.—T. Rotta (trading as Chemische Fabrik T. Rotta) and K. Quehl. Feb. 27, 1935. 4365/36.

PROCESS FOR THE RECOVERY OF VOLATILE SOLVENTS in extraction plants for oils and fats.—Montecatini Soc. Générale per L'Industria Mineraria ed Agricola. Feb. 25, 1935. 5150/36.

PROCESS FOR THE MANUFACTURE OF ESTERS, especially of ethyl acetate.—Usines de Melle. Feb. 27, 1935. 5178/36.

PROCESS FOR STABILISING CELLULOSE ESTERS.—N. V. Gevaert Photo Producten. Feb. 25, 1935. 5500-1/36.

SURFACE-ACTIVE COMPOUNDS and their manufacture.—E. I. du Pont de Nemours and Co. Feb. 25, 1935. 5531/36.

TEMPERATURE CONTROL OF REACTION VESSELS.—Houdry Process Corporation. Feb. 26, 1935. 5673/36.

PROCESS AND APPARATUS FOR EXTRACTING ORGANIC ACIDS from their diluted aqueous solutions.—F. Blumenthal, T. Schultz, and Soc. Immobiliere et Industrielle Anversoise (S. I. M. I. N. A.) Soc. Anon. Feb. 28, 1935 5760/36

SYSTEM ENABLING LEAKAGES OF LIQUID PUMPS TO BE RECOVERED.—P. Gauthier. Feb. 27, 1935. 5781/36.

MANUFACTURE OF DYESTUFFS and intermediate products.—Soc. of Chemical Industry in Basle. Feb. 28, 1935. 5910/36.

PROCESS FOR THE MANUFACTURE OF INTERMEDIATE PRODUCTS FOR DYESTUFFS.—I. G. Farbenindustrie. Feb. 27, 1935. 5914/36.

PROCESS FOR MANUFACTURING cleansing, wetting out, foaming, dispersing, equalising, and bleaching agents and treatment baths for the textile, leather, and similar industries.—Naamlooze Vennootschap Chemische Fabriek Servo, and M. D. Rozenbroek. Feb. 27, 1935. 5948/36.

PROCESS FOR PURIFYING FINELY DIVIDED CARBON which has been formed on iron-containing contacts by decomposition of carbon monoxide.—Bayerische Stickstoff-Werke A.-G. Feb. 28, 1935. 6080/36.

Specifications Accepted with Date of Application

CRACKING AND COKING HYDROCARBON MIXTURES.—H. A. Brassert and Co., A. Fisher and H. A. Brassert. Nov. 19, 1934. 452,500.

PROCESS OF WASHING OR CLEANSING TEXTILE MATERIALS.—W. W. Groves (I. G. Farbenindustrie). Nov. 23, 1934. 452,649.

DISTILLATION OF TAR AND LIKE HYDROCARBON OILS.—H. G. C. Fairweather. (Barrett Co.). Nov. 27, 1934. 452,710.

PRODUCTION OF CELLULOSE ETHERS.—J. F. Pollak (Naamlooze Vennootschap Algemeene Chemische en Technische Maatschappij Achetem). Dec. 20, 1934. 452,506.

PROCESS OF MANUFACTURING, washing, cleasing, wetting, and emulsifying agents and treatment baths containing the same.—Naamlooze Vennootschap Chemische Fabriek Servo and M. D. Rozenbroek. Jan. 24, 1934. 452,508.

COOKING OF DRYING OILS and/or varnishes.—H. V. A. Briscoe. Jan. 26, 1935. 452,653.

PRODUCTION OF ACYL DERIVATIVES of germinal gland hormone preparations.—Schering-Kahlbaum A.-G. Feb. 22, 1934. 452,716.

TREATMENT OF TEXTILES AND LEATHER.—W. W. Groves (I. G. Farbenindustrie). Feb. 25, 1935. 452,577.

MANUFACTURE OF FLUORINATED ORGANIC COMPOUNDS.—I. G. Farbenindustrie. Feb. 24, 1934. 452,579.

PREHEATING CARBONACEOUS MATERIALS prior to destructive hydrogenation and like conversion processes.—Coutts and Co. and F. Johnson (legal representatives of J. Y. Johnson (deceased)). (I. G. Farbenindustrie). Feb. 25, 1935. 452,512.

MANUFACTURE OF AMINOSULPHONIC ACIDS.—A. Carpmael (I. G. Farbenindustrie). Feb. 25, 1935. 452,584.

MANUFACTURE OF WATER-IN-SOLUBLE AZO DYESTUFFS.—A. Carpmael (I. G. Farbenindustrie). Feb. 25, 1935. 452,720.

MANUFACTURE OF DERIVATIVES OF PARAFFIN WAX.—C. Ockrent, N. Bennett, and Imperial Chemical Industries, Ltd. Feb. 26, 1935. 452,659.

MANUFACTURE OF COMPOUNDS FROM HALOGENATED PARAFFIN WAX. C. Ockrent, D. W. F. Hardie, and Imperial Chemical Industries, Ltd. Feb. 26, 1935. 452,660.

MANUFACTURE OF PRODUCTS FROM PARAFFIN WAX.—C. Ockrent, N. Bennett, and Imperial Chemical Industries, Ltd. Feb. 26, 1935. 452,661.

PROCESS FOR THE MANUFACTURE OF ORGANIC COMPOUNDS containing fluorine.—I. G. Farbenindustrie. Feb. 26, 1934. 452,656.

MANUFACTURE OF ESTERS of the aliphatic series.—E. I. du Pont de Nemours and Co., and H. J. Barrett. Feb. 26, 1935. 452,658.

MANUFACTURE OF CHLORINATED PARAFFIN WAXES.—C. Ockrent and Imperial Chemical Industries, Ltd. Feb. 26, 1935. 452,662.

MANUFACTURE OF 4 : 5-ALKYL-SUBSTITUTED 2-AMINO-DIARYLKETONES.—W. W. Groves (I. G. Farbenindustrie). Feb. 28, 1935. 452,845.

VESSELS, PIPES, APPARATUS, AND PARTS THEREOF capable of resisting chemical corrosion.—Metallges, A.-G. March 3, 1934. 452,731.

PREPARATION OF EASILY SOLUBLE SALTS of dialkyl-amino-alkyl-amino-acridines.—P. May (Soc. des Usines Chimiques Rhone-Poulenc). March 30, 1935. 452,805.

PRODUCTION OF SULPHUR DIOXIDE.—Gas Light and Coke Co. and W. G. Adam. April 25, 1935. 452,525.

MANUFACTURE AND PRODUCTION OF ACETALDEHYDE.—Coutts and Co. and F. Johnson (legal representatives of J. Y. Johnson (deceased)) (I. G. Farbenindustrie). May 10, 1935. 452,527.

READILY EMULSIFIABLE MINERAL OIL COMPOSITIONS.—International Hydrogenation Patents Co., Ltd. May 11, 1934. 452,811.

MANUFACTURE OF EMULSIONS.—A. G. Bloxam (Soc. of Chemical Industry in Basle). May 27, 1935. 452,532.

EXTRACTION AND RECOVERY OF FERTILISING MATERIALS contained in the wash of distilleries, and for the purification of said wash.—Soc. Industrielle de Nouveaux Appareils S. I. N. A. Dec. 13, 1934. 452,549.

DISTILLATION TREATMENT OF MATERIALS containing hydrocarbons. J. Swallow. March 16, 1936. 452,702.

Applications for Patents

(August 27 to September 2 inclusive.)

PROCESS FOR SULPHURISING ORGANIC COMPOUNDS.—Dr. Alexander and Posnansky, C. Sandvoss. March 21, '35. (Germany, March 26, '34.) 23985.

MANUFACTURE OF ZINC DUST.—Alloys Co. (United States, Aug. 30, '35.) 23813.

MANUFACTURE OF PREPARATIONS OF SEXUAL HORMONES.—A. G. Bloxam (Soc. of Chemical Industry in Basle). 23544.

MANUFACTURE OF OLEFINE PRODUCTS.—A. Carpmael (I. G. Farbenindustrie.) 23649.

MANUFACTURE OF SULPHONIC ACID AMIDE COMPOUNDS.—A. Carpmael (I. G. Farbenindustrie.) 23724.

MANUFACTURE OF LEAD.—A. Carpmael (I. G. Farbenindustrie.) 23725.

MANUFACTURE OF CONDENSATION PRODUCTS of the phenanthrene series.—A. Carpmael (I. G. Farbenindustrie.) 23851.

MANUFACTURE OF CONDENSATION PRODUCTS.—Challenge Adhesives, Ltd. (Germany, Aug. 30, '35.) 23860.

DYEING PROCESS.—M. A. Dahlen, S. R. Detrick, F. Zwilgmeyer and R. E. Etzelmiller. 23584.

REFINING OLEFINE SULPHIDE.—W. W. Duecker, C. R. Payne. 23821.

DYEING PROCESS.—E. I. du Pont de Nemours and Co., G. D. Groves. 23584.

MANUFACTURE OF AMINO-ALCOHOL ESTERS OF ACRYLIC ACID.—E. I. du Pont de Nemours, G. D. Groves. 23958.

DEVICE FOR ADJUSTING GRINDING-DISC OF GRINDING MACHINES.—L. S. E. Ellis (Maag-Zahnrader und Maschinen). 23833.

MANUFACTURE OF NEW AMINO-ALCOHOLS.—L. S. E. Ellis (Soc. des Usines Chimiques Rhone-Poulenc). 24048.

APPARATUS FOR FILLING CONTAINERS WITH LIQUIDS.—I. G. Farbenindustrie. 23662.

MANUFACTURE OF ZINC SULPHIDE CONTAINING PIGMENTS.—I. G. Farbenindustrie. (Germany, Aug. 31, '35.) 23850.

MANUFACTURE OF GELATINE.—Imperial Chemical Industries, Ltd., J. V. S. Glass. 23585.

SPLITTING-UP OF EXTRACTS.—F. D. Johnson (I. G. Farbenindustrie). 23820.

LOCAL ANESTHETIC BASES, ETC.—Novocol Chemical Manufacturing Co., Inc. (United States, Oct. 5, '35.) 23932.

PROCESS FOR SULPHURIZING ORGANIC COMPOUNDS.—K. W. Posnansky. March 21, '35. (Germany, March 26, '34.) 23985.

MANUFACTURE OF STABLE CALCIUM THIOSULPHATE, ETC.—Schering-Kahlbaum. (Germany, Sept. 14, '35.) 23581.

MANUFACTURE OF DIHYDROFOLLICLE HORMONE.—Schering-Kahlbaum. March 24. 24084.

MANUFACTURE OF HYDROAROMATIC NITROGEN COMPOUNDS.—W. J. Tennant (Henkel and Cie, Ges.). 23686.

PRODUCTION OF X-RAY PHOTOGRAPHS.—W. P. Williams (Schering-Kahlbaum). 23722.

MANUFACTURE OF DI- AND TRI-IODO DERIVATIVES OF ACYLAMINO ACIDS and their salts.—W. P. Williams (Schering-Kahlbaum). 23723.

From Week to Week

THE ANNUAL DINNER, DANCE AND CABARET of the Institute of Fuel will be held at the Connaught Rooms, London, on October 15.

THE AGREEMENT that has been a subject of negotiation between the Amalgamated Engineering Union and Imperial Chemical Industries, Ltd., has been finally drafted and is to be referred to the union for ratification by its membership on September 15.

THE PRODUCTION OF BRIQUETTES or manufactured fuel in the United Kingdom dropped from 877,224 tons in 1934 to 857,031 tons last year, the decline in value being from £815,898 to £775,707.

A REGULATION HAS BEEN ISSUED in Copenhagen prohibiting, as from October 1, the sale in Denmark of flour containing persulphate. A translation of the regulation may be inspected at the Department of Overseas Trade, 35 Old Queen Street, S.W.1.

DAMAGE ESTIMATED at over £400 was caused by a fire which originated in the paint works of L. Darbyshire and Sons, Monton Road, Eccles, last week. Electrical and cellulose spraying machinery was extensively damaged.

AN EXTENSION of the chemical department, Shieldhall, Glasgow, at a cost of £80,000 has been agreed to by the directors of the Scottish Co-operative Wholesale Society, subject to the approval of the shareholding societies. The scheme will be considered at the quarterly meeting in Edinburgh to-day (Saturday).

A SIXTEEN-PAGE SUPPLEMENT on the chemical industry was published with the "Daily Telegraph" on Monday. The supplement reviewed in popular language the great services which the chemist and the chemical engineer are rendering to the community in connection with foodstuffs, agriculture, engineering, by-product recovery, special steels, prevention of corrosion and the scientific treatment of air and poisonous fumes.

KING GEORGE'S JUBILEE TRUST, acting through the East End Hostels Association, the name of which it is now proposed to change to the London Hostels Association, of which Sir Ernest Benn is the president, has arranged to purchase Ingram House, Stockwell, as a working boys' hostel. The building is to be renamed King George's House, and it is hoped that it may be ready for the reception of working boys by the end of the year.

GOOD PROGRESS HAS BEEN MADE with the erection of the factory at Lochboisdale, South Uist, by Cefoil, Ltd., for the production of transparent wrapping material from seaweed. Its opening will make a big difference to employment on the island, as a large number of men will be absorbed, not only in the factory, but also in gathering the seaweed. Two other factories are to be built, and may restore some of the prosperity lost to the Western Isles when the profitable kelp industry declined.

THE CHELSEA SCHOOL OF METALLURGY (Chelsea Polytechnic) has issued its prospectus for the 1936-1937 session. Enrolling days are next Thursday and Friday (day students 10 a.m. to 12 noon and evening students 6 to 9 p.m.). The autumn term begins on September 21, the Lent term on January 11, and the summer term on April 15. A junior course in industrial metallurgy extending over two years (October to May) has been arranged for boys from 14 to 17 years of age, a senior course consisting of 24 lectures, for technical representatives and others interested in metallic goods, a two-year course in engineering metallurgy, and two special courses of seventeen weeks each in fuels and refractory materials and electro metallurgy.

SIR JOHN CADMAN, chairman of the Anglo-Iranian Oil Co., in a paper presented at the third World Power Conference at Washington on Monday, referred to the possibility of exhaustion of the world's petroleum resources in some twenty years' time. Commenting on the paper, the Anglo-Iranian Oil Co. points out that mention was made, in broad terms only, of estimates which have appeared recently in various technical publications, and that Sir John expressed no opinion as to their accuracy. The sole object of the reference was to draw attention to the undoubted desirability of doing everything possible to prevent waste in the production, and the utilisation of nature's valuable—but gradually diminishing—source of liquid fuel.

AN EXPLOSION AT ALTRINCHAM GASWORKS on Tuesday, resulted in the death of an elderly woman, Mrs. Murray, who was in the habit of selling mineral waters at the works, injuries to a number of workmen and girls, and a fierce fire. The explosion occurred in the gas-distributing department, adjoining the purifying room. Mr. George Gilder, the works superintendent, was flung several yards by the force of the explosion. Later the body of Mrs. Murray was found under a pile of masonry, near the scene of the explosion. It appears that while a new valve was being fixed there was an escape of gas and one or two of the men were affected by the fumes. By some means the gas was ignited before aid could be given to the affected men, and the explosion followed.

A FACTORY OF THE GERMAN DYE TRUST at Frankfurt has been wrecked by an explosion. Three watchmen are stated to have been injured. The factory was about 200 feet long.

THE NAME of B. and G. Manufacturing Co., Ltd., 3 Grays Inn Place, Gray's Inn, London, W.C.1, has been changed to Industrial and General British Trading Co., Ltd.

THE FIRM of R. and J. Garroway, of Glasgow, manufacturers of superphosphate and other chemicals, have restored a cut in workmen's wages which was made in 1931. The firm has initiated this year a week's holiday with pay for all workers.

A DECLARATION OF SOLVENCY was filed on September 3 relating to Animal Food Products, Ltd. The authorised capital is £12,000 in £1 shares, all of which had been issued and fully paid-up in cash to August 30, 1935. At the date named Imperial Chemical Industries, Ltd., owned 500 shares, Lord Weir 7,400 and Sir Ernest Jardine, 500.

THE BOARD OF TRADE has made an order entitled "The Explosives in Coal Mines (Hydrox and Cardox) Order, 1936," consolidating and amending the Explosives in Coal Mines (Hydrox) Order, 1935, and the Explosives in Coal Mines (Cardox) Order, 1934, which permit and regulate the use of Hydrox and Cardox cartridges in mines under the Act.

SEVERAL IMPORTANT CONTRACTS have lately been received by Edgar Allen and Co., Ltd., as follows: (1) For the Aberthaw and Bristol Channel Portland Cement Co., Ltd., clinker grinding plant comprising two 8 ft. by 45 ft. combination tube mills, complete with Fuller-Kinyon pumping and conveying equipment and dust collecting plant. (2) For the Chinnor Cement and Lime Co., Ltd., clinker grinding plant, comprising one 6 ft. by 34 ft. combination tube mill and cement handling auxiliaries. This plant is a duplicate of existing cement grinding equipment supplied some years ago. (3) For a large chemical works, a special large rotary kiln, which is a duplicate order for a similar kiln recently installed in this country and now in operation. (4) For two gold mines in South Africa, six tube mills, 6 ft. 6 in. in diameter by 24 ft. long for crushing gold ore. These mills are similar to eight mills previously supplied for the same purpose. The total value of the orders runs into tens of thousands of pounds.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

South Africa.—The British Trade Commissioner at Johannesburg reports that the South African Railways and Harbours Administration is calling for tenders for the supply and delivery of 20 tons of nickel chrome steel, $1\frac{3}{4}$ in. diameter by 11 ft. long. Tenders, endorsed "Tender No. 982 Nickel Chrome Steel," should be addressed to the Chief Stores Superintendent, South African Railways and Harbours, Park Station Chambers, Johannesburg, by whom they will be received up to noon on Wednesday, September 30. (Ref. T.30,738.)

Austria.—A general agent for metal goods, etc., established at Vienna, wishes to obtain the representation, on a commission basis, of United Kingdom exporters of special steels, nickel and chromium plated strip, copper and brass bars, alloys, etc. (Ref. No. 230.)

Books Received

A Text-Book of Organic Chemistry. By the late Dr. Julius Schmidt. English Edition by Dr. H. Gordon Rule. London: Gurney and Jackson. Pp. 865. 25s.

Survey of Imports, Raw Materials, and Synthetic Products, and their Relationships to the Old and Newer Industries, with special reference to the position in the Humber Area. By Arnold R. Tankard. Hull: City of Hull Development Committee. Pp. 54. 2s. 6d.

Air Raid Precautions Handbook No. 1. Personal Protection Against Gas. London: H.M. Stationery Office. Pp. 100. 6d.

Air Raid Precautions Handbook No. 2. (2nd. Edition). First Aid for Gas Casualties. London: H.M. Stationery Office. Pp. 48. 4d.

Air Raid Precautions Memorandum No. 1. (2nd Edition). Organisation of Air Raid Casualties Services. London: H.M. Stationery Office. Pp. 32. 6d.

Air Raid Precautions Memorandum No. 2. (2nd Edition). Rescue Parties and Clearance of Debris. London: H.M. Stationery Office. Pp. 10. 2d.

Weekly Prices of British Chemical Products

PRICES of general heavy chemicals have remained unchanged during the week. In the coal tar products section the price of medium soft pitch has been reduced to 35s. per ton. Unless otherwise stated the prices below cover fair quantities net and naked at sellers' works.

MANCHESTER.—Conditions on the Manchester chemical market during the past week have been pretty well back to normal and so far as the general movement into consumption is concerned in most quarters a more active state of affairs is reported compared with the experience of the last month or so. The alkali products and many of the potash compounds, as well as the heavy acids, are being called for in steady quantities against contracts, and from now on until the end of the year reasonably satisfactory conditions are anticipated. The majority of chemical users in Lancashire are well covered for supplies and no more than a moderate amount of fresh business has been reported this week, principally for near delivery positions. For the most part, quotations are well held.

GLASGOW.—There has been a slight improvement in the demand for general chemicals for home trade during the week but export business still remains very limited. Prices continue steady about previous figures, but lead and copper products are very firm in sympathy with the metals. A bright tone persists in the coal tar products market for all more refined distillates, while the heavier products remain comparatively dull. Inquiries have been numerous for carbolic and cresylic acids, pyridine and special fractions of high tar acid oil, while solvent naphtha and heavy naphtha continue to command 1s. 4d. to 1s. 5d., and 1s. to 1s. 1d. respectively. All these products are moving well and in quantity. If September may be regarded as the closing month of the road tar season, it seems likely that large quantities of crude material must still be in manufacturers' hands.

General Chemicals

ACETONE.—£62 to £65 per ton; SCOTLAND: £64 to £65 ex wharf, according to quantity.

ACID, ACETIC.—Tech., 80%, £30 5s. to £32 5s. per ton; pure 80%, £32 5s. to £34 5s.; tech., 40%, £16 12s. 6d. to £18 12s. 6d.; tech., 60%, £23 10s. to £25 10s. SCOTLAND: Glacial 98/100%, £48 to £52; pure 80%, £32 5s.; tech., 80%, £30 5s., d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £30 5s.; tech. glacial, £42 to £46.

ACID, BORIC.—Commercial granulated, £27 per ton; crystal, £28; powdered, £29; extra finely powdered, £31; packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. B.P. cryst., £36; B.P. powder, £37. SCOTLAND: Crystals, in 1 cwt. bags, £28; powdered, in 1 cwt. bags, £29.

ACID, CHROMIC.—Flaked, 10d. per lb., less 2½%; ground, 10¼d. per lb., less 2½%, d/d U.K.

ACID, CITRIC.—1s. per lb. MANCHESTER: 11¾d. to 1s. SCOTLAND: B.P. crystals, 1s. per lb., less 5%.

ACID, CRESYLIC.—97/99%, 3s. to 3s. 1d. per gal.; pale, 98%, 3s. 1d. to 3s. 2d.; dark, 2s. 6d. to 2s. 7d.; 99/100%, refined, 3s. 4d. to 3s. 6d. per gal. MANCHESTER: 99/100%, pale, 3s. 9d.

ACID, FORMIC.—85%, in carboys, ton lots, £42 to £47 per ton.

ACID, HYDROCHLORIC.—Spot, 4s. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works, full wagon loads.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £50: pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £18 to £25 per ton makers' works. SCOTLAND: 80°, £24 ex station full truck loads.

ACID, OXALIC.—£48 15s. to £57 10s. per ton, according to packages and position. SCOTLAND: £2 10s. per cwt. in casks. MANCHESTER: £49 to £54 per ton ex store.

ACID, SULPHURIC.—SCOTLAND: 144° quality, £3 12s. 6d.; 168°, £7; dearsenicated, 20s. per ton extra.

ACID, TARTARIC.—1s. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. SCOTLAND: 11¾d. less 5%. MANCHESTER: 11¾d. to 1s. per lb.

ALUM.—SCOTLAND: Ground, £10 2s. 6d. per ton; lump, £9 12s. 6d.

ALUMINA SULPHATE.—LONDON: £7 10s. to £8 per ton. SCOTLAND: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

AMMONIUM CARBONATE.—SCOTLAND: Lump, £30 per ton; powdered, £33, in 5-cwt. casks d/d buyers' premises U.K.

AMMONIUM CHLORIDE.—LONDON: Fine white crystals, £18 to £19. (See also Salammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

AMMONIUM SULPHATE.—Neutral quality, 20.6% nitrogen, £6 16s. per ton.

ANTIMONY OXIDE.—SCOTLAND: £61 to £65 per ton, c.i.f. U.K. ports.

ANTIMONY SULPHIDE.—Golden, 6½d. to 1s. 1d. per lb.; crimson, 1s. 5½d. to 1s. 7d. per lb., according to quality.

ARSENIC.—LONDON: £13 10s. per ton c.i.f. main U.K. ports for imported material; Cornish nominal, £22 10s. f.o.r. mines. SCOTLAND: White powdered, £17 10s. ex store. MANCHESTER: White powdered Cornish £18 10s. ex store.

ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.

BARIUM CHLORIDE.—LONDON: £10 10s. per ton. SCOTLAND: £11.

BARYTES.—£6 10s. to £8 per ton.

BISULPHITE OF LIME.—£6 10s. per ton f.o.r. London

BLEACHING POWDER.—Spot, 35/37%, £7 19s. per ton in casks, special terms for contracts. SCOTLAND: £9.

BORAX, COMMERCIAL.—Granulated, £14 10s. per ton; crystal, £15 10s.; powdered, £16; finely powdered, £17; packed in 1-cwt. bags, carriage paid home to buyer's premises within the United Kingdom in 1-ton lots. SCOTLAND: Granulated, £14 10s. per ton in 1 cwt. bags, carriage paid.

CADMIUM SULPHIDE.—3s. 8d. to 3s. 11d. per lb.

CALCIUM CHLORIDE.—Solid 70/75% spot, £5 5s. per ton d/d station in drums. SCOTLAND: £5 10s. per ton net ex store.

CARBON BISULPHIDE.—£31 to £33 per ton, drums extra.

CARBON BLACK.—3¾d. to 4¾d. per lb. LONDON: 4½d. to 5d.

CARBON TETRACHLORIDE.—SCOTLAND: £41 to £43 per ton, drums extra.

CHROMIUM OXIDE.—10¾d. per lb., according to quantity d/d U.K.; green, 1s. 2d. per lb.

CHROMETAN.—Crystals, 2⅝d. per lb.; liquor, £19 10s. per ton d/d

COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r. or ex works.

CREAM OF TARTAR.—£3 19s. per cwt. less 2½%. LONDON: £3 17s. per cwt. SCOTLAND: £3 18s. net.

DINITROTOLUENE.—66/68° C., 9d. per lb.

DIPHENYLGUANIDINE.—2s. 2d. per lb.

FORMALDEHYDE.—LONDON: £24 10s. per ton. SCOTLAND: 40%, £25 to £28 ex store.

IODINE.—Resublimed B.P., 6s. 3d. to 8s. 4d. per lb.

LAMPBLACK.—£24 to £26 per ton.

LEAD ACETATE.—LONDON: White, £33 15s. per ton; brown, £1 per ton less. SCOTLAND: White crystals, £34 to £35; brown, £1 per ton less. MANCHESTER: White, £34, brown £33.

LEAD NITRATE.—£32 10s. to £34 10s. per ton.

LEAD, RED.—SCOTLAND: £31 per ton less 2½%, carriage paid.

LEAD, WHITE.—SCOTLAND: £39 per ton, carriage paid. LONDON: £41.

LITHOPONE.—30%, £16 to £16 5s. per ton.

MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store.

MAGNESIUM CHLORIDE.—SCOTLAND: £6 17s. 6d. per ton.

MAGNESIUM SULPHATE.—Commercial, £5 per ton, ex wharf.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

PARAFFIN WAX.—SCOTLAND: 3⅝d. per lb.

PHENOL.—6¾d. to 7½d. per lb.

POTASH, CAUSTIC.—LONDON: £42 per ton. MANCHESTER: £38 10s.

POTASSIUM BICHROMATE.—Crystals and Granular, 5d. per lb. less 5%, d/d U.K. Ground, 5½d. LONDON: 5d. per lb. less 5%, with discounts for contracts. SCOTLAND: 5d. per lb. less 5% carriage paid. MANCHESTER: 5d.

POTASSIUM CHLORATE.—LONDON: £37 to £40 per ton. SCOTLAND: 4¼d. per lb. MANCHESTER: £39 per ton.

POTASSIUM CHROMATE.—6½d. per lb. d/d U.K.

POTASSIUM IODIDE.—B.P., 5s. 2d. per lb.

POTASSIUM NITRATE.—SCOTLAND: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 8¼d. per lb. SCOTLAND: B.P. Crystals 8¾d. MANCHESTER: B.P. 10¾d. to 11½d.

POTASSIUM PRUSSIATE.—LONDON: Yellow, 7½d. to 8d. per lb. SCOTLAND: 7½d. net, ex store. MANCHESTER: Yellow, 8¼d. to 8½d.

SALAMMONIAC.—First lump spot, £41 17s. 6d. per ton d/d in barrels. SCOTLAND: Large crystals, in casks, £36.

SODA ASH.—58% spot, £5 12s. 6d. per ton f.o.r. in bags.

SODA, CAUSTIC.—Solid, 76/77° spot, £13 17s. 6d. per ton d/d station. SCOTLAND: Powdered 98/99%, £17 10s. in drums, £18 5s. in casks, Solid 76/77°, £14 12s. 6d. in drums; 70/73%, £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. MANCHESTER: £13 5s. to £14 contracts.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags

SODIUM ACETATE.—LONDON: £21 per ton. SCOTLAND: £17 15s. per ton net ex store.

SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. SCOTLAND: £12 10s. per ton in 1 cwt. kegs, £10 15s. per ton in 2 cwt. bags. MANCHESTER: £10 10s.
SODIUM BICHROMATE.—Crystals cake and powder 4d. per lb. net d/d U.K. discount 5%. Anhydrous, 5d. per lb. LONDON: 4d. per lb. less 5% for spot lots and 4d. per lb. with discounts for contract quantities. MANCHESTER: 4d. per lb. SCOTLAND: 4d., less 5% carriage paid.
SODIUM BISULPHITE POWDER.—60/62%, £20 per ton d/d 1 cwt. iron drums for home trade.
SODIUM CARBONATE, MONOHYDRATE.—£15 per ton d/d in minimum ton lots in 2 cwt. free bags. Soda crystals, SCOTLAND: £5 to £5 5s. per ton ex quay or station. Powdered or pea quality, 7s. 6d. per ton extra. Light Soda Ash, £7 ex quay, min. 4-ton lots with reductions for contracts.
SODIUM CHLORATE.—£29 per ton. SCOTLAND: £1 10s. per cwt.
SODIUM CHROMATE.—4d. per lb. d/d U.K.
SODIUM HYPOSULPHITE.—SCOTLAND: Large crystals English manufacture, £9 5s. per ton ex stations, min. 4-ton lots. Pea crystals, £14 10s. ex station, 4-ton lots. MANCHESTER: Commercial, £10 5s.; photographic, £14 10s.
SODIUM IODIDE.—B.P., 6s. per lb.
SODIUM METASILICATE.—£14 per ton, d/d U.K. in cwt. bags.
SODIUM NITRITE.—LONDON: Spot, £18 5s. to £20 5s. per ton d/d station in drums.
SODIUM PERBORATE.—10%, 9¾d. per lb. d/d in 1-cwt. drums. LONDON: 10d. per lb.
SODIUM PHOSPHATE.—£13 per ton.
SODIUM PRUSSIATE.—LONDON: 5d. to 5½d. per lb. SCOTLAND: 5d. to 5¾d. ex store. MANCHESTER: 5d. to 5½d.
SODIUM SILICATE.—140° Tw. Spot, £8 per ton. SCOTLAND: £8 10s.
SODIUM SULPHATE (GLAUBER SALTS).—£4 2s. 6d. per ton d/d SCOTLAND: English material, £3 15s.
SODIUM SULPHATE (SALT CAKE).—Unground spot, £3 12s. 6d. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 2s. 6d. to £3 5s.
SODIUM SULPHIDE.—Solid 60/62% Spot, £10 15s. per ton d/d in drums; crystals 30/32%, £8 per ton d/d in casks. SCOTLAND: For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 7s. 6d., d/d buyer's works on contract, min. 4-ton lots. Spot solid, 5s. per ton extra. Crystals, 2s. 6d. per ton extra. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8.
SODIUM SULPHITE.—Pea crystals, spot, £13 10s. per ton d/d station in kegs. Commercial spot, £8 15s. d/d station in bags.
SULPHATE OF COPPER.—MANCHESTER: £15 per ton f.o.b. SCOTLAND: £16 10s. per ton less 5%.
SULPHUR.—£9 to £9 5s. per ton. SCOTLAND: £8 to £9.
SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quality.
SULPHUR PRECIP.—B.P., £55 to £60 per ton according to quantity. Commercial, £50 to £55.
VERMILION.—Pale or deep, 5s. 1d. per lb. in 1-cwt. lots.
ZINC CHLORIDE.—SCOTLAND: British material, 98%, £18 10s. per ton f.o.b. U.K. ports.
ZINC SULPHATE.—LONDON: £12 per ton. SCOTLAND: £10 10s.
ZINC SULPHIDE.—10d. to 11d. per lb.

Nitrogen Fertilisers

SULPHATE OF AMMONIA.—September, £6 16s. per ton; October, £6 17s. 6d.; November, £6 19s.; December, £7 0s. 6d. for neutral quality basis 20.6% nitrogen delivered in 6-ton lots to farmer's nearest station.
CALCIUM CYANAMIDE.—September, £6 16s. 3d. per ton; October, £6 17s. 6d.; November, £6 18s. 9d.; December, £7; carriage paid to any railway station in Great Britain in lots of 4 tons and over.
NITRO-CHALK.—£7 5s. per ton to end of September.
NITRATE OF SODA.—£7 12s. 6d. per ton to end of September.
CONCENTRATED COMPLETE AND AMMONIUM PHOSPHATE FERTILISERS.—£10 12s. to £11 1s. per ton, according to specification. N.P. fertilisers £10 5s. to £13 15s. per ton for minimum 6-ton lots delivered buyer's nearest station.

Coal Tar Products

ACID, CRESYLIC.—97/99%, 3s. to 3s. 1d. per gal.; 99/100%, 3s. 4d. to 4s. per gal., according to specification; pale 98%, 3s. to 3s. 1d.; dark, 2s. 4d. to 2s. 5d. GLASGOW: Pale, 99/100%, 2s. 9d. to 3s. 3d. per gal.; pale, 97/99%, 2s. 6d. to 2s. 9d.; dark, 97/99%, 2s. 3d. to 2s. 4d.; high boiling acids, 1s. 8d. to 2s.; American specification, 2s. 9d. to 3s.
ACID, CARBOLIC.—Crystals, 6¾d. to 7½d. per lb.; crude, 60's, 2s. 3d. to 2s. 6d. per gal. MANCHESTER: Crystals, 6¾d. per lb.; crude, 2s. 7d. to 2s. 8d. per gal. GLASGOW: Crude, 60's, 2s. 4d. to 2s. 6d. per gal.; distilled, 60's, 2s. 8d. to 3s.
BENZOL.—At works, crude, 8½d. to 9d. per gal.; standard motor 1s. 2d. to 1s. 2½d.; 90%, 1s. 3d. to 1s. 3½d.; pure, 1s. 7d. to 1s. 7½d. LONDON: Motor, 1s. 3½d. GLASGOW: Crude, 8½d. to 9d. per gal.; motor, 1s. 2d.
CREOSOTE.—B.S.I. Specification standard, 5½d. per gal. f.o.r. Home, 3¾d. d/d. LONDON: 4½d. f.o.r. North: 5d. London. MANCHESTER: 4¾d. to 5¾d. GLASGOW: B.S.I. Specification, 5½d. to 5¾d. per gal.; washed oil, 4½d. to 4¾d.; lower sp. gr. oils, 4¾d. to 5d.
NAPHTHA.—Solvent, 90/100%, 1s. 5½d. to 1s. 6½d. per gal.; 95/160%, 1s. 7d.; 90%, 1s. to 1s. 2d. LONDON: Solvent, 1s. 3½d. to 1s. 4d.; heavy, 11d. to 1s. 0½d. f.o.r. GLASGOW: Crude, 5½d. to 6d. per gal.; 90% 160, 1s. 4d. to 1s. 5d.; 90% 190, 1s. to 1s. 1d.
NAPHTHALENE.—Crude, whizzed or hot pressed, £12 to £13 per ton; purified crystals, £22 10s. per ton in 2-cwt. bags. LONDON: Fire lighter quality, £5 to £5 10s. per ton; crystals, £27 to £27 10s. GLASGOW: Fire lighter, crude, £7 to £8 per ton (bags free).
PYRIDINE.—90/140%, 6s. to 7s. per gal.; 90/180, 2s. 3d. GLASGOW: 90% 140, 6s. to 6s. 6d. per gal.; 90% 160, 5s. to 5s. 6d.; 90% 180, 2s. 6d.
TOLUOL.—90%, 1s. 11d. per gal.; pure, 2s. 3d. GLASGOW: 90% 120, 1s. 10d. to 1s. 11d. per gal.
XYLOL.—Commercial, 2s. per gal.; pure, 2s. 2d. GLASGOW: Commercial, 1s. 11d. to 2s. per gal.
PITCH.—Medium, soft, 35s. per ton, in bulk at makers' works. MANCHESTER: 32s. 6d. f.o.b., East Coast. GLASGOW: f.o.b. Glasgow, 30s. to 35s. per ton; in bulk for home trade, 32s. 6d.

Wood Distillation Products

ACETATE OF LIME.—Brown, £8 to £8 10s. per ton; grey, £10 5s. to £10 15s. Liquor, brown, 30° Tw., 8d. per gal. MANCHESTER: Brown, £9; grey, £10.
CHARCOAL.—£5 to £10 per ton, according to grade and locality.
METHYL ACETONE.—40-50%, £45 to £48 per ton.
WOOD CREOSOTE.—Unrefined 6d. to 1s. 6d. per gal., according to boiling range.
WOOD, NAPHTHA, MISCIBLE.—2s. 9d. to 3s. 3d. per gal.; solvent, 3s. 9d. per gal.
WOOD TAR.—£2 to £2 10s. per ton.

Intermediates and Dyes

ACID, BENZOIC, 1914 B.P. (ex toluol).—1s. 9½d. per lb. d/d buyer's works.
ACID, GAMMA.—Spot, 4s. per lb. 100% d/d buyer's works.
ACID, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.
ACID NAPHTHIONIC.—1s. 8d. per lb.
ACID, NEVILLE AND WINTHER.—Spot, 3s. per lb. 100%.
ACID, SULPHANILIC.—Spot, 8d. per lb. 100%, d/d buyer's works.
ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.
ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.
BENZIDINE, HCl.—2s. 5d. per lb., 100% as base, in casks.
o-CRESOL 30/31° C.—6d. per lb. in 1-ton lots.
p-CRESOL 34-5° C.—1s. 6d. per lb. in ton lots.
m-CRESOL 98/100%.—1s. 7d. per lb. in ton lots.
DICHLORANILINE.—1s. 11¼d. to 2s. 3d. per lb.
DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.
DINITROBENZENE.—8d. per lb.
DINITROTOLUENE.—48/50° C., 9d. per lb.; 66/68° C., 10½d.
DINITROCHLORBENZENE, SOLID.—£72 per ton.
DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works
α-NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.
β-NAPHTHOL.—In bags, £88 15s. per ton; in casks, £89 15s.
α-NAPHTHYLAMINE.—Lumps, 1s. per lb.; ground, 1s. 0½d.
β-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb., d/d buyer's works in casks.
o-NITRANILINE.—3s. 11d. per lb.
m-NITRANILINE.—Spot, 2s. 7d. per lb., d/d buyer's works.
p-NITRANILINE.—Spot, 1s. 8d. per lb., d/d buyer's works.
NITROBENZENE.—Spot, 4½d. to 5d. per lb.; 5-cwt. lots, drums extra.
NITRONAPHTHALENE.—9d. per lb.; P.G., 1s. 0½d. per lb.
SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb.
o-TOLUIDINE.—9½d. to 11d. per lb.
p-TOLUIDINE.—1s. 11d. per lb.
m-XYLIDINE ACETATE.—4s. 3d. per lb., 100%.

Latest Oil Prices

LONDON, Sept. 9.—LINSEED OIL was firm. Spot, £28 5s. (small quantities); Sept. and Sept.-Dec., £25 15s.; Jan.-April, £25 12s. 6d.; May-Aug., £25 10s., naked. SOYA BEAN OIL was quiet. Oriental (bulk) spot, Rotterdam, £24 10s. RAPE OIL was quiet. Crude, extracted, £34 10s.; technical refined, £35 10s., naked, ex wharf. COTTON OIL was firm. Egyptian crude, £29; refined common edible, £32 10s.; deodorised, £34 10s., naked, ex mill (small lots £1 10s. extra). TURPENTINE was steady. American, spot, 39s. 3d. per cwt.

HULL.—LINSEED OIL, spot, quoted £26 7s. 6d. per ton; Sept. and Sept.-Dec., £25 17s. 6d.; Jan.-April, £25 15s. COTTON OIL, Egyptian crude, spot, £29 10s.; edible refined, spot, £32; technical, spot, £32; deodorised, £34, naked. PALM KERNEL OIL, crude, f.m.q., spot, £24 10s., naked. GROUNDNUT OIL, extracted, spot, £34; deodorised, £37. RAPE OIL, extracted, spot, £33 10s.; refined, £34 10s. SOYA OIL, extracted, spot, £30; deodorised, £33 per ton. COD OIL, f.o.r. or f.a.s., 25s. per cwt. in barrels. CASTOR OIL, pharmaceutical, 43s. per cwt.; firsts, 38s.; seconds, 36s. TURPENTINE, American, spot, 42s. per cwt.

Company News

Eastman Kodak Co.—Operations for the twenty-four weeks ended June 13 resulted in net profit of $8,081,870, compared with $7,048,951 for the corresponding periods of 1935. The profit per share of common stock is $3.51 ($3.05).

Celanese Corporation of America.—A dividend of $1.75 per share on the 7 per cent. cumulative series prior preferred stock has been declared payable on October 1 to stockholders of record at the close of business on September 18.

Broken Hill South, Ltd.—It is announced that the net profit for the year to end-June amounts to £486,197—an increase of £143,687 on the preceding twelve months. Of this total the mining section of the company's business contributed £387,747, while £98,450 was received from the investment section.

Lawes Chemical Co.—The net profit for 12 months to end of June amounts to £10,263 (£10,606); add £2,679 brought forward, making £12,942. Dividend 5 per cent., less tax (same), to depreciation and renewals £800 (same), to general reserve £1,009, leaving £2,148 forward. Sales of land resulted in £11,115 being placed to reserve. The report states that to develop sales a further subsidiary was acquired during the year.

Boots Pure Drug Co., Ltd.—The directors have declared a quarterly interim dividend of 6 per cent., less tax, to be paid on September 30 to all ordinary shareholders recorded on September 10. A similar payment was made at this time last year, when dividends totalling 24 per cent., less tax, were followed by a bonus of 3d. per share, or 5 per cent., tax free.

South African Carbide and By-Products.—The following dividends have been announced for the year ended August 31, 1936: On preference shares, 8 per cent., plus additional dividend of 9.7293d. per share, and on ordinary shares, 8 per cent., plus additional dividend of 1d. per share (8 per cent.). Dividends are declared in currency of the Union of South Africa and became due on September 1, but warrants in payment will be posted both from head and London offices on or about September 15, an interval being necessary for balancing of books and preparation of warrants. Warrants despatched from London office to persons resident in Great Britain or Northern Ireland will be subject to deduction of United Kingdom tax at rates to be arrived at after allowing for relief (if any) in respect of Dominion taxes.

United Glass Bottle Manufactures.—An interim dividend of 2½ per cent. is to be paid on the ordinary shares in respect of the year ending December 31 next, on September 17.

Alexander Duckham and Co.—An interim of 5 per cent., less tax, is announced on the ordinary shares, payable on September 15.

United Indigo and Chemical Co.—The profit for the year to end June amounts to £8,418 (£8,720); available balance £20,697 (£19,404). Ordinary dividend 6¼ per cent. (5 per cent.). Excess payment 1¼ per cent. on 5 per cent. preference shares, leaving £15,291 to be carried forward (£16,779.)

Canadian Celanese, Ltd.—A dividend of 40 cents per share on the common stock has been declared payable on September 30 to holders registered at the close of business on September 18. This follows two payments of a similar amount in March and June and makes a total of $1.20 per share up to the present in respect of the current year. No payments had been made on the common stock prior to March this year.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Bill of Sale

MURRAY, HUMPHREY DESMOND, 9 Elm Place, South Kensington, consulting chemist and director of a company. (B.S., 12/9/36.) Dated Aug. 31. Filed Sept. 5. £50.

Company Winding-Up

ELECTRO CHEMICAL PROCESSES, LTD. (C.W.U., 12/9/36.) Statutory meetings, Bankruptcy Buildings (Room 53), Carey Street, Lincoln's Inn, London, W.C.2, Sept. 17. Creditors, 2.30 p.m., Contributories, 3 p.m.

Chemical and Allied Stocks and Shares

THERE has been a tendency for business in the industrial and allied sections of the Stock Exchange to increase further since the commencement of the new account on Monday. Shares of chemical and associated companies were more active in many cases, but there have been few important movements in prices as compared with a week ago. Imperial Chemical were reported to be in larger request, and although now "ex" the interim dividend are little changed on balance at 39s. 7½d. Greeff-Chemicals Holdings were steady at 9s. and the preference at 11s. 10½d. are also unchanged in price. Timothy Whites and Taylors remained at 30s. 3d. and were firm, hopes of a larger dividend having persisted in the market. The chairman has stated in the past that it might take some considerable time for full benefits to accrue from the amalgamation represented by the company, but the assumption in the market is that profits have probably been assisted favourably by the larger spending power of the public.

Boots Pure Drug 5s. shares were higher at 58s. There was increased attention given to Borax Consolidated deferred shares around 35s. 6d., there being hopes that the company may possibly announce the resumption of interim dividend payments during the next few weeks. Salt Union were steady at 43s. Cooper McDougall and Robertson remained steady, pending declaration of the interim dividend. Fison, Packard and Prentice were higher around 47s. 9d. United Premier Oil and Cake lost a few pence to 11s. 10½d. but were active on interim dividend expectations. British Oil and Cake Mills preferred ordinary have gone back moderately to 49s. 10½d., but they are now "ex" their interim payment. British Tar Products 5s. shares came in for more attention around 11s. 9d. aided by hopes that the distribution may again be brought up to 15 per cent., the rate which has ruled for some years. Triplex Safety Glass were less prominent prior to the annual meeting.

Unilever made a higher price and at 35s. 7½d. are fully 1s. above the level ruling a week ago. There are now hopes in the market that a moderately larger interim dividend may be announced later in the year, but it seems to be generally believed that all question of an increase will probably be left until the final payment. Imperial Smelting kept at the lower price of 15s. 9d. made recently. Goodlass Wall and Lead Industries received more attention on the higher price of lead, which, if continued, may assist the net profits favourably as the company's strikes the latter after writing down stocks in a conservative manner. B. Laporte were more active, judging from recorded "markings" of business, but remained at 130s. The 3s. shares of William Blythe transferred around 7s. 6d. Cellon were prominent, these 5s. shares having risen to over 20s.

Tarmac ordinary shares moved up to close on 36s.; in their last report the directors mentioned that arrangements had been made for the supply of large amounts of blast furnace slag from the Corby works of Stewarts and Lloyds. The shares of the latter company have made the higher price of 35s. 6d. in response to renewed talk of the possibility of the tube cartel being re-established, as this would make export trade less difficult. United Molasses received increased attention on current dividend estimates which range from 12 per cent. to 16 per cent. Distillers did not keep best prices but have moved up further on balance to 109s. 3d. General Refractories 10s. shares remained in good demand around 35s. Although there is no increase in the interim dividend, the view in the market is that a satisfactory increase in the total dividend is in prospect.

United Glass Bottle were slightly lower at 48s. 6d., but they are "ex" the interim dividend of 2½ per cent. This is another company which is making no change in its interim, but which is considered in the market to offer reasonable possibilities of an increased final payment. Last year the total dividend was 10 per cent., but if profits had been distributed up to the hilt 20 per cent. could have been paid. British Plaster Board received more attention and these 5s. shares are 45s. 6d. at the time of writing. The tendency in the market is to emphasise that the company's business is probably broadly based in view of the fact that gypsum is used in many trades and for a variety of purposes. Turner and Newall continued to attract a good deal of attention. In this case the market is talking of a possible increase in dividend to 17½ per cent. Associated Portland Cement and other cement shares were inclined to reflect profit-taking following their recent good upward movement. Oil shares were prominent, largely owing to favourable dividend estimates and the encouraging views expressed in many quarters as to the outlook for the oil industry.